SCIENCE

5 NOVEMBER 1954

VOLUME 120 NUMBER 3123

Experiments in Microevolution: *R. W. Gerard* 727

Chicago Radiocarbon Dates V: *W. F. Libby* 733

News and Notes

Advances in International Conservation; Recent Progress in Hormone Research; and Regular Departments 742

Book Reviews

Snow Crystals; Chemistry of the Defect Solid State; Thomas Young, Natural Philosopher; Energy Transfer in Hot Gases; Essays on the Social History of Science; Elements of Statistical Mechanics; Histology; New Books; and Miscellaneous Publications 755

Technical Papers

Susceptibility to Experimental Atherosclerosis and the Methylation of Ethanolamine-1,2-C^{14} to Phosphatidyl Choline: *L. O. Pilgeram* and *D. M. Greenberg* 760

Similarities in Histochemical Differentiation of Insect Cuticle and the Walls of Parasitic Fungi: *A. G. Richards* 761

Histamine Liberation *in vitro* and Mode of Binding of Histamine in Tissues: *A. L. Grossberg* and *H. Garcia-Arocha* 762

In vivo Activity of Pantothenylcyst(e)ine for Rats and Chicks: *R. Q. Thompson* and *O. D. Bird* 763

Association Affairs

Special Events at the Berkeley Meeting: *R. L. Taylor* 765

New AAAS Sections 766

A Problem for Educators 9A

Meetings & Conferences 16A

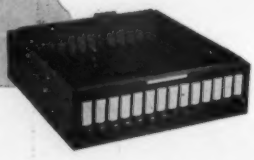
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

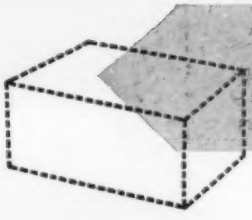
how Lab-aid's

45% greater capacity

cuts filing costs . . . saves floor space

a single Lab-aid cabinet holds up to 6500 (average) 1" microslides.





other type files need up to this much more space to hold as many.

How can a "Lab-aid" filing cabinet pack so much in so little space?

Look at one to see. You'll find no thick bulkheads between drawers, no space-consuming buttresses, no bulky tracking guides.

Every cubic inch inside is a hard-working "storage inch." The patented "Lab-aid" construction gets fourteen full-length drawers in a cabinet only 19" square. Yet, close-set as they are, every drawer slides straight and true, easily, smoothly, without binding.

Drawers are freely interchangeable, too. Use 1", 2", and 4" capacity full-length drawers in the same unit, in any arrangement you want, for microslides, transparencies, lantern slides, cards, etc. And use *any* of them *anytime* for *spaced* filing instantly. Lift out the separator, and you clear the drawers for close-packed storage.

Other units in the "Lab-aid" line provide for flat-filing microslides . . . for filing paraffin blocks, for "frame-spread" transparency filing. All are staunchly built of heavy gauge steel, strongly welded throughout. All have the same basic 19" square dimension, so they stack rigidly to any convenient height.

Write for the catalog describing these uniquely efficient "Lab-aid" filing cabinets..

. . . because every inch is a *filing* inch

TECHNICON **Lab-aid**

laboratory filing equipment

THE TECHNICON COMPANY
215 East 149 St., New York 51, N. Y.

These same Cabinets are manufactured by our French Corporation:
COMPAGNIE TECHNICON ● 7 rue Georges Ville ● Paris

Rapid... Accurate... Reproducible...

MOISTURE DETERMINATIONS

The NEW cenco *Infrared* MOISTURE BALANCE

for use with such materials as—
FLOUR
POPCORN
SORGHUM MILO
SOIL
HAY
RICE
FOUNDRY SANDS
DRY MILK PRODUCTS
OATS
PAPER
CLAY
SUGAR BEET PULP
SOYBEAN MEAL
CERAMICS
FOOD PRODUCTS

Measures either solid or liquid samples.

Here is an entirely new CENCO development which measures moisture content by weighing and drying *simultaneously*. It utilizes an improved principle of operation in drying the sample by infrared radiation and weighing by a sensitive null-point torsion balance. As a result, extremely rapid, accurate and reproducible moisture determinations are easily made.

The CENCO Moisture Balance has been used successfully for determining moisture content in a wide variety of materials. New developments now make it possible to measure liquids as well as solid samples. Disposable pans are also available at low cost for use with greasy, oily, tacky, and adhesive materials eliminating the need for cleaning.

Operation is quite simple. The scale is calibrated directly in per cent moisture from 0 to 100% in .2% divisions. Final reading indicates the percentage of moisture content.

Write for Bulletin No. 1210B.

No. 26675 Cenco Moisture Balance, $226.50 No. 26678 disposable pans for solids or liquids, Pkg. of 25, $2.20. 4 pkgs. of 25, $8.00.

cenco

CENTRAL SCIENTIFIC COMPANY
1718-N IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

Refinery Supply Company (Tulsa • Houston)

THE Reco FRACTION COLLECTOR FOR CHROMATOGRAPHY

CHECK THESE IMPORTANT FEATURES OFFERED BY THE NEW RECO MODEL F1200

TWO METHODS OF COLLECTION ... timed-flow and volumetric. FULLY AUTOMATIC ... whether set for timed-flow or volumetric operation. COLLECTS UP TO 400 SAMPLES ... resulting in sharper differentiation of components. READILY INTERCHANGEABLE RECEIVER PLATES ... affording widely varied volumes per fraction. FOUR CHROMATOGRAPHIC COLUMNS CAN BE OPERATED SIMULTANEOUSLY ... each delivering into an individual row of tubes. COLLECTS SAMPLES ON A VOLUME BASIS AS SMALL AS 3CC ... and up to 90 ml. with standard receiver plates. Timed Interval Between Tubes from 30 Seconds to 50 Minutes. Samples in Full View for Ready Observation. ACCURATE ... and Completely Dependable in Performance.

STANDARD EQUIPMENT: *Stand with four stainless steel support posts. Heavy duty worm gear reduction motor with indexing mechanism. Two receiver plates: one holding 400 13 mm tubes, the other 100 25 mm tubes. Three volumetric siphon assemblies. Timer/Controller.*

PRICE: RECO Model F1200 Fraction Collector, complete $525.00

Literature describing the complete line of RECO Paper Partition Chromatographic Equipment and Supplies sent on request.

Write for Brochure F10 describing the Reco Fraction Collector.

MANUFACTURER

RESEARCH EQUIPMENT Corporation

1135 THIRD STREET • OAKLAND, CALIFORNIA

AAAS MEMBERS

THE NEW OFFICIAL EMBLEM

An Attractive Symbol of Membership

IS NOW AVAILABLE

Lapel Buttons and Pins ..... **$1.50 incl. tax**

Gold filled scalloped border and lettering
Background in dark blue enamel
Torch in red enamel
Size and design as illustrated

Keys (Available only to AAAS Fellows) ..... **$2.70 incl. tax**

Same basic design, colors, and materials as buttons and pins
Border background in black enamel
Gold-filled edges and pinion
Size and design as illustrated

Mail your order now

TO: American Association for the Advancement of Science
1515 Massachusetts Avenue, N.W.
Washington 5, D. C.

Please accept my order for the emblem checked below.
My check or money order in the amount of $ ..... is enclosed.

☐ Lapel button $1.50
☐ Pin $1.50
☐ Key $2.70

Prices include Federal Tax and Postage

NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

MICROTOME KNIFE SHARPENER, KNIVES, AND ACCESSORIES

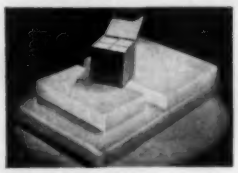
IMPROVED Aloe Microtome Knife Sharpener

No water or abrasive powder is necessary

Features outstanding simplicity of operation. Only a small amount of abrasive paste is required on wheel—no water or abrasive powders needed. Integral knife holder supports knife over its full length up to 13½ inches to permit more uniform treatment. After sharpening both sides, knife is stroked a few times on the strop to give the final finish. Adjusting knife holder and sharpening wheel for bevel has been eliminated. Equipped with split phase ¼ h.p. motor. Mechanism is enclosed in a crackle finish, cast metal housing with aluminum platform. Rubber feet protect table top. Over-all dimensions: 14¾ inches long by 21 inches wide by 9½ inches high.

JL60040—Simplified Aloe Electric Microtome Knife Sharpener, with adjustable strop assembly, one stick of abrasive paste, one jar of abrasive powder, one bottle of special solvent, cord and plug. For operation on 115 volts A.C., each.....$295.00

JL60068—Adjustable Strop Assembly, with one horsehide and one linen strop mounted in cast metal frame, with adjustable tension; with one ounce of abrasive powder, each.....$37.50



New Aloe Tissue-Embedding Paraffin

JL64644 — Tissue-Embedding Paraffin, in blocks. Melting point range (please specify): 50-52°, 54-5°, 56-58°; 25 lb. pkg. $6.60

JL64646—Same (specify melting point); per 100 lb. package..... 23.25

JL64642—Same, 1⅝-inch cubes. Specify melting point; lots, 1 to 9 lbs., per lb.....$0.45
In lots of 10 lbs. or more, per lb.....$0.40

New Minot-Type Microtome Knives

Handle extensions, increase usable portion of cutting edge; one sharpening lasts twice as long.

JL59912 — Aloe Minot Heavy-Duty Microtome Knives:

Length, cutting edge, mm.....	100	185
Total length, mm.....	185	315
Length, each extension, mm....	40	65
Width of blade, mm.....	35	45
Each*.....	$22.50	$37.50

*10% *discount in lots of* 6, *one or assorted sizes.*
*15% *discount in lots of* 12, *one or assorted sizes.*

aloe scientific DIVISION OF A. S. ALOE COMPANY • 5655 Kingsbury • St. Louis 12, Mo.

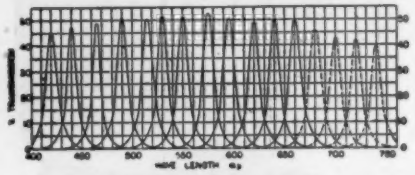
Los Angeles 15, 1150 S. Flower St. · San Francisco 5, 500 Howard St. · Seattle 1, 1920 Terry Ave. · Minneapolis 4, 927 Portland Ave. · Kansas City 2, 4128 Broadway · New Orleans 12, 1425 Tulane Ave. · Atlanta 3, 492 Peachtree St., N.E. · Washington 5, D. C., 1501 14th St., N.W.

SCIENCE is published weekly by the AAAS, 1515 Massachusetts Ave., NW, Washington 5, D. C. Entered at the Lancaster, Pa., Post Office as second class matter under the act of March 3, 1879. Annual subscriptions: $7.50; foreign postage, outside the Pan-American Union, $1; Canadian postage, 50¢.

G.A.B. Interference Filters

(Made in Switzerland)

for isolating narrow spectral bands



Spectral Range: 400-900 millimicrons
Spectral Width: 12-15 mμ, Transm.: 45-50%
Size: 2" x 2". Other sizes on order.

For

Flame Photometry and Color Densitometry
Microscopy and Photomicrography
Colorimetry and Fluorimetry

also in reflectometry, light scattering measurements, microcolorimetry refractometry, polarimetry, and in all other fields requiring monochromatic light in the visible and near-infrared range.

Write for Bulletin #180 to

PHOTOVOLT CORP.
95 Madison Ave. New York 16, N. Y.

PHOTOVOLT
Line-Operated Electronic
MULTIPLIER-PHOTOMETER
Mod. 520-M

For the exact measurement of light values as low as 1/10,000 microlumen . . . for absorption and flame photometry, colorimetry through microscopes, scintillation measurements, fluorescence trace analysis, etc.

Write for Bulletin #360 to

PHOTOVOLT CORP.
95 Madison Ave. New York 16, N. Y.

RESEARCH BIOCHEMICALS
OF
HIGHEST POSSIBLE PURITY

FOR INVESTIGATIONAL USES

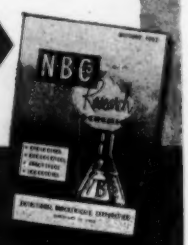
AMINO ACIDS
A complete selection of more than 100 Amino Acids

Pre-tested for rigid specification adherence to assure highest possible purity for exacting requirements of Biochemical Research.

Typical Amino Acids

GAMMA AMINO BUTYRIC ACID
ASPARAGINE, D, DL, L
CANAVANINE SULPHATE
DL CITRULLINE
DL DIHYDROXYPHENYLALANINE
GLUTAMINE
HOMOCYSTEINE
HYDROXY-L-PROLINE
METHIONINE, D, DL, L
METHIONINE, SULFONE, SULFOXIDE
PHENYLALANINE, D, DL, L
SERINE, D, DL, L
THREONINE, D, DL, L
TRYPTOPHANE, D, DL, L
VALINE, D, DL, L

WRITE FOR NEW CATALOG
October 1954
Over 1200 Items



NBC

NUTRITIONAL BIOCHEMICALS CORPORATION
21010 MILES AVENUE • CLEVELAND 28, OHIO

SENSATIONAL OPTICAL BARGAINS

OPTICAL COLLIMATOR

This instrument, an item of war surplus, was originally designed to check navigational instruments. It is being used by industry as a collimator for optical instruments, for testing lenses for definition, as a source of infinite light, and for photographing reticles at infinity. It is also being purchased by many firms as a source for the fine lenses and parts it contains. Consists of a large cemented achromat, 5" in diameter, with a focal length of approximately 25", a pin point reticle lighted by a 6–8 volt bulb (to represent a star), a first-surface mirror to reflect the light from the reticle. Overall length 14⅝"; width of cradle 7⅝". Slightly used, but guaranteed in good working order. Shpg. wt. 15 lbs.

Stock No. 80,025-W ..... **$95.00 f.o.b. Barrington, N. J.**

STEREO MICROSCOPE

WITH CHANGEABLE OBJECTIVES

A $225 Value ONLY $95.00 Postpaid

Now! Depth in a Magnified Erect Image!

Fine, imported Binocular Microscope at a substantial saving. Used for inspections, examinations, counting, checking, etc. Erect image. 2 pairs of eyepieces, 2 pairs of objectives. Power range from 12X to 75X. Variable interocular distance. Will accommodate standard eyepieces, reticles. Rack and pinion variable tension focusing. Hardwood carrying case included. Accessories available. Recommended for lab, shop, factory or home use. We guarantee complete satisfaction.

Order Stock No. 70,036-W ..... **$95.00 Postpaid**

Send check or M.O. or order on open account

Optical Parts from $12,000 U.S. Govt. Height Finder—Mounted Objectives, Penta Mirror Assemblies, Eyepiece Assemblies, etc. Write for Bulletin #25-W

New! 2 in 1 Combination!
Pocket-Size
50 POWER MICROSCOPE and 10 POWER TELESCOPE
ONLY
$4.50 ppd.

Useful Telescope and Microscope combined in one amazing, precision instrument. Imported! No larger than a fountain pen. Telescope is 10 Power. Microscope magnifies 50 Times. Sharp focus at any range. Handy for sports, looking at rare objects, just plain snooping.

Order Stock #30,059-W **$4.50 ppd.**

Send Check or M.O. Satisfaction Guaranteed!

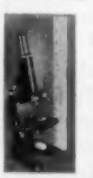
SPITZ JR. PLANETARIUM

One of the Greatest Scientific Toys We Have Ever Offered!

Designed by Armand Spitz, world-famous maker of the Spitz Planetarium. Projects nearly 400 stars, more than 70 constellations in their correct relationships. Use it in any darkened room of the house, project it on the ceiling. No batteries, works on ordinary household current. Two simple adjustments that show you the sky as it appears from any point in your hemisphere . . . for any month of the year! Rheostat control for brightness. 32-page book included free of extra cost. Contains valuable information about the stars, provides easy identification of the constellations.

About 14" high on a 7" base. Projection sphere 7" diameter. Weight 3 lbs.

Stock No. 70,040-W ..... **$15.00 Postpaid**



IMPORTED MICROSCOPE

100, 200, 300 Power

1 Ocular, 3 Objective Lenses, Rack & Pinion Focusing Revolving disc-light adjustable mirror. Square stage 2¾" x 2¾". Truly a wonderful bargain. TRY IT FOR TEN DAYS—if not completely satisfied, your money refunded. Comes packed in sturdy, hardwood case. Accessory eyepieces and objective available.

Stock No. 70,008-W ..... **$14.95 Postpaid**

FREE! Clip this ad for 93-page book "Hunting With the Microscope" sent free! Regular advertised price 60¢. Limited time only!

$74.50 4¼" ASTRONOMICAL TELESCOPE

"PALOMAR, JR."

A REAL REFLECTOR TELESCOPE

complete with equatorial mount, tripod!

Designed by us to meet every need of the amateur astronomer! Specially engineered not only for blueprint precision, but for comfort, ease of operation and freedom from mechanical restrictions! 4¼" mirror guaranteed to give theoretical limit of resolution. Diagonal and combination eyepiece finished to equal or better tolerances than mirror. Look at all these revolutionary features: Real rack and pinion, micrometer-smooth focusing with tension adjustment. Two piece rigid diagonal construction. All-aluminum black anodized tube. No-distortion adjustable mirror mount, easily removed for mirror cleaning. Tube ventilated. Real equatorial mount—one smooth motion follows stars, planets. Sturdy hardwood tripod. Counterweight for perfect balance.

Technical specifications: mirror aluminized, overcoated with silicon monoxide. Speed f/11. Focal length 45". Combination eyepiece, gives powers of 57X (20mm.) and 115X (10mm.). A 6mm. eyepiece, available from us at extra cost, gives 190-power. All eyepieces are standard 1¼" size. Focus travel of eyepiece mount is 2¼". Tube finished in jet black, accessories in black wrinkle finish. Tripod stained natural wood.

Stock No. 85,006-W ..... **complete** ..... **$74.50 f.o.b. Barrington, N. J.**

LOOK! INFRA-RED ITEMS!

INFRA-RED LIGHT and ITS USES

16 page illustrated Booklet dealing with all phases of Infra-Red projects—including Telescopes, Infra-Red microscopy-photography, watch-dog systems and communications. Includes list of materials.

Stock No. 9040-W ..... **75¢ Pstpd.**

INFRA-RED FILTERS — 5⅜" dia.

For use with infra-red telescopes, camera attachments, etc. Light from a 100-watt bulb passing through the filter is transformed to infra-red light source. Used on jeep headlights with infra-red driving instruments. ⅛" thickness.

Stock No. 60,033-W ..... **$2.00 ea. Pstpd.**

INFRA-RED IMAGE TUBE

Used inside an infra-red telescope, this miniature tube converts infra-red rays to visible rays on the tube screen, which is viewed by an ocular. British import. Cylindrical shape, approximately 2" diameter, 1⅝" long. Requires standard vibra-pack electrical source.

Stock No. 50,046-W ..... **$7.95 Pstpd.**

"MAKE-YOUR-OWN" 4¼" MIRROR KIT

The same fine mirror as above, polished and aluminized, lenses for eyepieces and diagonal. No metal parts.

Stock No. 50,074-W .. **$16.25 pstpd.**

60° SPECTROMETER PRISM

Polished surfaces flat to ½ wave-length. Angle tolerances 5 minutes. Dimensions of polished surfaces 18mm. x 30mm. Made from dense flint glass, free of striae and strain. Ideal for use with all models of spectrometers.

Stock No. 38,143-W ..... **$8.25 Pstpd.**

IF YOU'RE INTERESTED IN OPTICAL BARGAINS
Write for FREE CATALOG W
We Have Literally Millions of War Surplus Lenses and Prisms for Sale at Bargain Prices. Numerous Types of Instruments Too!

ORDER BY STOCK NO. Satisfaction Guaranteed Send Check or M. O.

EDMUND SCIENTIFIC CORP., BARRINGTON, N. J.

NO MORE MARKING PROBLEMS!

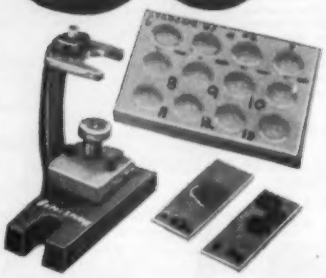
TECH-PEN

marks them all PERMANENTLY

Write on GLASS • METAL • PORCELAIN • PAPER • PLASTIC • CLOTH • LEATHER . . . almost *any* surface . . . by carrying just *one* marking tool: the new all-purpose Tech-Pen. Its clear, brilliant ink will not wash or wear off, is resistant to autoclaving, acids, alkalies, and most laboratory reagents, yet is easily removed with common solvents if desired. Red resists temperatures *up to 1000° C* . . . yellow, blue, green, orange, black or white resists temperatures up to 500° C.

Including an ink supply sufficient for 25,000 characters, price of the versatile Tech-Pen is $4.00 (additional refills are 75¢ per tube). F.O.B., New York, N. Y.

ORDER YOURS TODAY



PALO LABORATORY SUPPLIES, Inc.
Formerly Palo-Myers, Inc.
81 Reade Street • New York 7, N. Y.

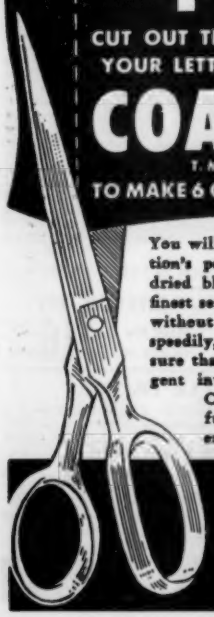
FREE!

CUT OUT THIS AD AND PIN IT TO YOUR LETTERHEAD FOR ENOUGH

COAGUSOL

T. M. REG. U. S. PAT. OFF.

TO MAKE 6 GALLONS OF SOLUTION!



You will find that a COAGUSOL solution's penetrating action strips stains, dried blood and tissue from even the finest serration of surgical instruments, without soap, without scrubbing—speedily, economically. Because we are sure that you will find this new detergent invaluable—we ask you to try COAGUSOL at our expense. For full information and your generous sample, write right now to

HOSPITAL LIQUIDS *Incorporated*
PRODUCTION LABORATORIES
Milledgeville, Georgia

SENSATIONALLY LOW PRICED

UMECO Binocular Microscope Model E3N

Highly Praised By Leading Scientists

One states, "Not one high priced, famous brand I've used can boast a quality that surpasses the E3N."

ACCEPTED FOR ADVERTISING IN PUBLICATIONS OF THE AMERICAN MEDICAL ASSOCIATION

Outstanding Features

Calibrated Mechanical Stage to 0.1 mm
ABBE 3-lens Condenser N.A. 1.4
Graduated Decentering Device
Research Type Substage for Polaroid work
Quadruple nosepiece: Achromatic, 5X, 10X, 40X, 100X coated.
Monocular tube for photomicrography.
Three Eyepieces: Huygenian. 5X, 10X, 15X.
Magnification: 25X to 1500X with monocular tube, increased to 30X to 2250X Binocular. 100X Oil immersion coated.

Thoroughly tested and inspected before delivery. Inquire about UMECO Monocular Microscope, and Greenough Type Stereo-microscope.

Write for complete Specifications and Prices

UMECO OPTICAL COMPANY
Dept. 11S
465 California Street
San Francisco 4, Calif.

What General Electric People Are Doing...

QUIET TUBE

The U.S. Navy Bureau of Ships is interested in anything which would extend the range of its early-warning radar stations. Since a target is identified by distinguishing a pip on a radar screen from smaller, noise-generated irregularities, any reduction in noise would make the pip more discernible.

Our Research Laboratory has been working under Navy sponsorship for the past few years to design a strong, low-noise tube for microwave applications. Such a tube has now been developed, in collaboration with our Tube Department. In this tube, noise is reduced by keeping the electrodes extremely close together, thus reducing the transit time the electrons require to travel from cathode to grid. The shorter the transit time, the smaller the noise factor.

The new tube, designated GL-6299, is not a single-frequency device, although it was designed for use at microwave frequencies. In fact, it exhibits improved performance throughout the radio and audio-frequency ranges. For usefulness over a large frequency range, it has been made adaptable for use in circuits of the cavity, parallel-line, or lumped-constant type. Despite its small size, it operates at currents and voltages comparable to those of conventional receiving tubes. It is being marketed by our Tube Department in Schenectady.

TWO-EYE PERISCOPES

In atomic energy work, dealing with radioactive materials hidden behind protective barriers calls for the use of ingenious methods and equipment if it is necessary to see what you're doing. Until recently, the optical devices, called periscopes, which were used for this purpose were designed for single-eye use only.

Now engineers at our Hanford Atomic Products Operation have perfected a binocular design of periscope having stereoscopic vision. This new design, besides meeting all optical requirements, is yet mechanically simple to build, requires no adjustments, and cannot lose the alignment of its two images. Anyone with normal vision can use it with ease and comfort.

RADIOACTIVE SILICONES

Our Silicone Products Department in Waterford, New York, recently made joint announcement with Abbott Laboratories of North Chicago, Illinois, of an Abbott Laboratories project making radioactive silicones available for medicine and industry. Such silicones may prove to be a valuable research tool in certain areas. Radioactive silicone fluids, for example, are made readily measurable in minute amounts by the incorporation of Carbon-14, and they are expected to offer a clearer insight into the behavior of silicones in the human body than could previously be obtained.

The new fluids have been designed for laboratory and clinical test work. They will not be a part of finished medicinals sold to the consumer. In conformity with Atomic Energy Commission practice, such initial studies must be conducted on animals only.

NEW VACUUM PUMP

The vacuum being one of the most important tools of science, methods and devices for producing vacua are important parts of our research program.

Two of our research scientists at Schenectady have developed a new vacuum pump of extremely simple construction that operates on either a-c or d-c in the range from 1000 to 10,000 volts. The device apparently is capable of pumping any gas, even the inert gases. The current design consists of two disks made of some such material as carbon or titanium, mounted a little less than an inch apart in a round, stainless-steel box. Between the disks is a molybdenum ring electrode supported by a glass insulator.

The box is placed in the field of a permanent magnet in such a way that the flux is perpendicular to the disks; a tube connects the pump to the vessel to be evacuated. When a potential is applied between the ring and the disks, an electrical discharge occurs and electrons are attracted to the ring, but the axial magnetic field causes them to take a devious path. Electrons colliding with gas molecules produce positively charged ions, which are attracted to the disks and driven to the absorbing surfaces. Sputtering and secondary-emission effects aid the pumping action.

Using this device—so small it has a volume of but 20 cc—our scientists have evacuated a three-liter vessel containing hydrogen at a pressure of 50 microns of mercury at room temperature to 0.2 micron in approximately nine minutes.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Purina *laboratory animal* Nutrition News

FEEDING LABORATORY RABBITS

By H. C. Schaefer, Director, Laboratory Chow Research

Rabbits are playing an important role as experimental animals in hormone, bacteriology, and physiology research. They are also used in clinical laboratories and for the production of biologies. How to keep rabbits in top condition for critical experiments has been the prime object of Purina Research work for more than twenty-five years.

Purina developed Rabbit Chow Checkers as a nutritionally adequate diet for Laboratory Rabbits. This ration does not need to be supplemented with hay or any other feeding materials.

For laboratories desiring a ration free of antibiotics, Rabbit Chow Checkers is made in two forms, with or without antibiotics.

The following quantities of Rabbit Chow Checkers will keep rabbits in good physical condition during all phases of maintenance and stress:

Adults . . . 150 grams per day or 10 lbs. per month

Young Rabbits . . . 100 grams per day or 7 lbs. per month

Freshness of the ration has significant effect on its palatability to rabbits. The Ralston Purina Company makes a special effort to provide Rabbit Chow Checkers to all laboratories in fresh, palatable condition through its more than 5,000 dealers.

RALSTON PURINA COMPANY, St. Louis 2, Missouri

WITH OVER 5,000 DEALERS COAST TO COAST TO SERVE YOU

AAAS EDITORIAL BOARD

Duane Roller
Editor

Charlotte V. Meeting
Assistant Editor

Mark H. Adams — Bentley Glass
William R. Amberson — Karl Lark-Horovitz
Wallace R. Brode — Edwin M. Lerner
William L. Straus, Jr.

Advertising Representative: F. A. Moulton

A Problem for Educators

SCIENTIFIC research is conducted largely behind closed doors, and the accuracy of any man's observations and the veracity of his reports depend ultimately upon his honesty. This honesty depends in turn upon maturity, upon some degree of security, and upon a sense of identification and fellowship with competitors. Under present conditions it is a tribute to scientists that violations of their code of honor are so rare that when lapses occur they become historic scandals. This issue is especially delicate in such fields of science as psychology, psychiatry, and psychoanalysis, in which it is difficult to repeat another man's observations for purposes of objective clinical or experimental or statistical confirmation. Consequently in these disciplines, reports of observations become themselves sources of controversy and suspicion. For many reasons I suspect (although I cannot prove this) that we may be seeing today the birth of a new psychosocial ailment among scientists, one which may not be wholly related to the gangster tradition of dead-end kids.

Are we witnessing the development of a generation of hardened, cynical, amoral, embittered, disillusioned, young scientists? If so, for the present the fashioning of implements of destruction offers a convenient outlet for their destructive feelings; but the fault will be ours and not theirs if this tendency should increase through the coming years and should find even more disastrous channels of expression.

Certainly the idyllic picture of the innocent, childlike scientist who lives a life of simple, secure, peaceful, dignified contemplation has become an unreal fantasy. Instead, the emotional stresses of his career have increased to a point where only men of exceptional emotional maturity and stability can stand up to them for long, and remain clear-headed and generous-hearted under such psychologically unhygienic conditions. Thoughtful educators are beginning to realize that the socio-economic basis of the life of the scientist must be entirely overhauled; that the psychological setting of his life needs drastic revision; and that at the same time the emotional preparation for a life of research is at least as important as is the intellectual training.—LAWRENCE S. KUBIE, "Some unsolved problems of the scientific career," *Am. Scientist* **42**, 112 (1954), an excerpt from a two-part article.

Dr. Kubie is a practicing psychiatrist and clinical professor of medicine and mental hygiene at the Yale School of Medicine.

Education does not mean teaching people what they do not know. It means teaching them to behave as they do not behave. It is not teaching the youth the shapes of letters and the tricks of numbers, and then leaving them to turn their arithmetic to roguery, and their literature to lust. It means, on the contrary, training them into the perfect exercise and kingly continence of their bodies and souls. It is a painful, continual and difficult work to be done by kindness, by watching, by warning, by precept, and by praise, but above all—by example.—JOHN RUSKIN.

SCIENCE, founded in 1880, is published each Friday by the American Association for the Advancement of Science at Business Press, Lancaster, Pa. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

All correspondence should be addressed to SCIENCE, 1515 Massachusetts Ave., NW, Washington 5, D. C. Manuscripts should be typed with double spacing and submitted in duplicate. The AAAS assumes no responsibility for the safety of manuscripts or for the opinions expressed by contributors.

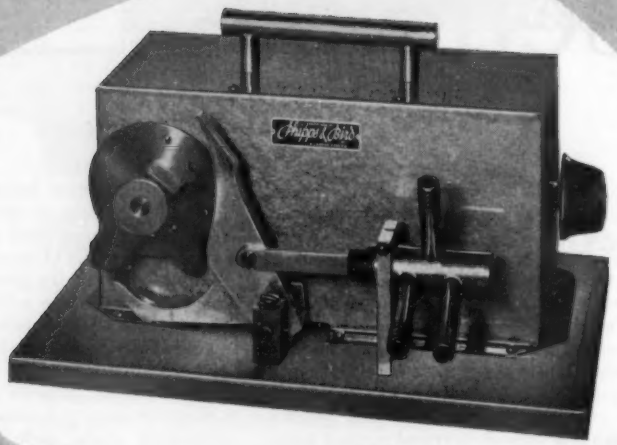
Change of address: The notification should reach us four weeks in advance. If possible, please furnish an address stencil label from a recent issue. Be sure to give both old and new addresses, including postal zone numbers, if any.

Annual subscriptions: $7.50; foreign postage, outside the Pan-American Union, $1.00; Canadian postage, 50¢. Single copies 25¢. Special rates to members of the AAAS.

The AAAS also publishes THE SCIENTIFIC MONTHLY.

PHIPPS & BIRD

VARI-PHASE VALVE



FOR CONTROLLING ARTIFICIAL RESPIRATION

This valve in conjunction with a source of compressed air is used to control artificial respiration.

Control of one knob facilitates respiration rates of 15 to 50 per minute. The inspiration to expiration time ratio may be set to any value between 1:4 to 4:1. By loosening one screw the valve may be removed for cleaning and sterilizing.

For operation on 115-volt, 60-cycle only.

CAT. NO. 71-216 $125.00

PHIPPS & BIRD, INC.

MANUFACTURERS AND DISTRIBUTORS OF SCIENTIFIC EQUIPMENT

6TH & BYRD STREETS — RICHMOND, VA.

Experiments in Microevolution*

R. W. Gerard

Neuropsychiatric Institute, Division of Psychiatry, Medical School, University of Illinois, Chicago

Foreword. In summarizing this symposium, I expressed to our hosts, the Office of Naval Research and the University of Pennsylvania, our deep appreciation for their hospitality and for what all agreed was the great success and stimulation of this meeting. It was rather good to see Government, and particularly military science, tied up with civilian science. It was also good to see the applied so deeply woven with the theoretical. We were concerned, of course, on the one hand, with the enormously important specific problems of the antibiotics, herbicides, and insecticides, with drug resistance and addiction, with the development of resistance to epidemics due to bacteria and other organisms. Yet, on the other hand, these very practical matters do reduce, I think, to the general theory of the interaction of systems with their environment over the course of time; and this is a problem of microevolution. So we were dealing, for those 2½ days, with modern experiments in the general field of evolution.

THE conditions of this summary precluded a talk prepared before the symposium, so I avidly collected notes and ideas as the talks proceeded. By the first evening I had much to say, but, alas, one point after another was disposed of by successive speakers and by the second evening my bag was again empty. Let me give some examples, a little in my own defense, but also to point out something later.

Scope of the Subject

H. B. Newcombe started with the question of whether the presence of specific drugs could not merely increase mutations but might actually direct them, so that specific resistant strains developed rapidly. I made a quick note, "Lamarckianism raising its head, something worthy of discussion." It surely was, and C. P. Martin's evening lecture constituted a courageous modern defense of this presumably defunct view. Also I had an idea: The presence of a nonspecific mutagenic agent ought to hasten the development of specific drug resistance in organisms, if this depends on selection from random mutations; so exposure to a combination of drug and radiation should bring about resistance faster than exposure to drug alone. As later appeared, this experiment was in the unpublished part of Newcombe's paper, and I am glad to know the results are positive.

The problem arose, in V. Bryson's comments, of the time lag between the genetic mutation in bacteria and the appearance of the induced phenotypic change—a lag covering some generations. I thought, "Well, this is the occasion to expand on the time aspect of these problems, on the importance of process in the interaction of a gene with its environment." I thought of emphasizing congenital as intermediate between genetic and subsequent environmental effects and of the varied consequences of a given change at various times. Thus, Mongolian idiocy seems to result from anoxia at an early stage in the development of the embryo, from damage to the placenta, and cataract results from German measles at a certain time in gestation. Then W. E. Loomis spoke about herbicides and corn and pointed out just such things. The time of application of 2,4-D in relation to the morphological stages determined, for example, whether tassels disappeared or ears lost their kernels.

A. C. R. Dean raised the problem of the actual molecular basis of adaptation: whether it be called a gene change or an enzyme change, whether something happens in the substrate-enzyme interaction or inter-availability, whether accelerators or inhibitors are involved, or what not. I decided to direct attention to the fact that a basic molecular change must be involved —and M. G. Sevag developed that theme extensively and effectively.

From vigorous discussion involving the fluctuation test, applied to bacterial cultures, the fact emerged that the results could be reconciled with either one of the theoretical interpretations—a genetic mutation or a physiological adaptation leading to resistance. Indeed, this was true for much of the evidence presented on both sides of the genetic-adaptation argument. And I thought: "It will be nice to point out that, since the consequences of two different theoretical interpretations are so nearly identical that it is practically impossible to devise experiments to discriminate crucially

* This was the last of the three papers presented during session V of the symposium on the *Origins of Drug Resistance and Related Problems* (microbicides, herbicides, insecticides, narcotics, alcoholism, carcinogenic and living agents). Session V aimed to integrate and summarize various points of view expressed during preceding sessions. The symposium, organized by M. G. Sevag (University of Pennsylvania) and Roger D. Reid and Orr E. Reynolds (Office of Naval Research), took place 25–27 March 1954 at the Hotel Statler, Washington, D.C., and 25 papers were presented by invited speakers from Europe, Canada, Japan, and U.S.A. The entire proceedings are being published by the Academic Press, New York. In view of the fact that "Experiments in microevolution" develops and integrates various topics of the symposium in an eloquent manner, the committee believes that its publication also in *Science* will serve a useful purpose.

between them, it does not make too much difference, unless the theories are basically different in the first place. I will show that the theories are not basically different, so the whole debate resolves to an operational problem." Then the operational approach was expounded with vigor by H. A. Schneider.

Loomis talked of the problem of finding herbicides to kill the weeds but spare the corn in a plot, and I thought of the comparable problem of killing cancer cells by circulating chemicals while sparing normal ones, but M. K. Barrett considered just this and explicitly posed the problem of the evolution of two interacting populations. The course of change when the interacting systems are each modifiable, as in the development of resistance or susceptibility of one organism to another, is, of course, a more difficult and exciting problem than is the modification of one organism in developing resistance or addiction to some fixed agent, such as a drug. But after this is pointed out, the rest is detail.

C. W. Kearns spoke of the enzyme that removes hydrogen chloride from DDT in resistant flies. "Aha, I shall relate this to immune phenomena, to the genetics of blood groups, the different lysins, agglutinins and all the rest." Barrett did just this with his report on cancer immunity, and he also anticipated my comments on the individually unique metabolic patterns, described by R. J. Williams. These also relate to immune factors in individuality, exemplified by Leo Loeb's lifetime work on tissue grafts, which showed that the success of takes parallels the blood (or genetic) relationship between graft and host.

At last it dawned on me that I was on the wrong track; I was, in effect, trying to out-plan the planners of this symposium. I submit as a remarkable fact that, in anticipation, they had clearly recognized the ramifications and implications of their problem, had already thought of all these points, and had invited appropriate speakers to develop and analyze these many aspects of the whole. I do warmly congratulate them upon their conceptualization and foresight.

Particular Problems

There remain, however, a few things that I can, with some profit, take up further. First a few particular comments on items, mentioned during the symposium, which did not have all the attention they deserve. When Martin said he knew of no mutation that had actually led to the selection of the species, I thought of an old experiment with a blue green mutation in caterpillars. The grass greens and blue greens kept their proper genetic proportions while grown in the laboratory; but on the open roof, with green plants as a background, the blue green caterpillars were quickly eliminated by hungry birds.

Martin also considered the role of temperature in determining whether or not white coat color actually appears in animals that tend to turn white in winter but do not always do so. The influence of temperature on animal and plant coloration has, of course, been widely studied; the interesting point he made was that, once a severe winter had induced a white coat to appear in an animal, whiteness recurred in subsequent seasons, even though the temperature remained moderate. I wonder whether a hormonal mechanism might be involved, the thyroid being activated by cold and the cycles running over a bit from one season to the next. Such a piling up of residues seems involved in the enlargement of the adrenal cortex with repeated stresses and outlasts the stress period by considerable time.

On the interaction of two populations, I cannot resist mentioning some work of a group in which I have participated, the Behavioral Science Group at the University of Chicago, with members ranging from mathematical biologists to political scientists. This group has considered with some care, during the past year, the predator-prey relationship, and has examined the phenomenological consequences of a variety of assumptions concerning the parameters and boundary conditions of the formal equations defining relationship. With rather small changes in conditions, one can get the full scale of time relationships between the predator and prey populations: increase of either to a maximum, or fall to a minimum, or moving to a steady equilibrium or to an oscillation with decrementing waves, or one incrementing to an "explosion" or, perhaps most interesting, to an oscillation with a "beat" of its waves. The most intricate population cycles are thus predicted from straightforward assumptions concerning the rules of interaction.

Williams emphasized the individual, uncontrollable drives that constitute alcoholism, the craving for alcohol, and related these to particular biochemical individual characteristics, perhaps genetically induced. I thought, in that connection, of much neurophysiological work on the problem of drives. Quite discrete lesions, placed in the appropriate parts of the lower brain, the hypothalamus, can induce in a variety of animals an irresistible craving for water, for food, or even for a particular kind of food, as in salt hunger. One can, with lesions or stimulations, as the case may be, induce a goat, for example, to drink a tub of water, even enough to kill itself, or can cause rats, supplied unlimited food, to eat themselves into spheres of fat. It would be interesting to examine the hypothalamus in human cases of chronic alcoholism and also to compare the food and water drives of operated animals with alcohol added or absent.

Having introduced the nervous system, as did N. B. Eddy and M. H. Seevers in discussing morphine addiction, I shall continue with some items that seem to me to involve this little-mentioned entity. Does morphine addiction involve rather specifically the most recently evolved part of the nervous system, the cerebral neurons, or is it a universal effect involving all kinds of cells? Evidence was cited both ways. The differential acquisition of resistance by the medulla so that respiratory failure ceases to be a danger, and by cells in tissue cultures so that they grow in considerable concentrations of the drug, cited by Eddy, certainly support the more general character of morphine resis-

tance. On the other hand, Seevers' statements that true addiction can be obtained only in animals with a large cerebrum and that acute toxic doses of morphine produce demyelinization only in this part of the nervous system favor the more specific locus of action.

It is interesting that prefrontal leucotomy, topectomy, and other operations to remove the frontal poles of the cerebral hemispheres or to separate them from the remaining brain parts—operations now widely performed under the general terms of psychosurgery, to relieve severe psychotic behavior or intractable pain—rather regularly eliminate any narcotic addiction that had been acquired during the painful period. The addiction is eliminated in the sense that the individual no longer craves morphine, but not that withdrawal symptoms fail to appear when the drug is stopped. An addicted dog can die on morphine withdrawal, even if decorticated.

If specific neurons are involved in morphine addiction, as some of these facts suggest, then one would guess that the mechanism could not be an extremely basic or general one. That is, if an agent such as morphine, is able to produce changes involving interneurons or cerebral neurons, but not other kinds of neurons, then the agent must act on something fairly specific to the sensitive cells and not on universally present enzymes, or the cell membrane, or anything common to all cells. Yet, much of the work on morphine addiction suggests to me that an adaptive enzyme develops under the action of the morphine, a general cellular response. Nalline, quite specifically, acts as a competitive inhibitor of this morphine-altering enzyme, so that nalline can precipitate the withdrawal symptoms of morphine even when morphine is present.

Another interesting point: one can induce a high resistance to the lethal action of epinephrine, in dogs particularly. This was shown first by Essex, who adapted animals over a period of several days, and we were able to establish the same tolerance to manyfold lethal doses by infusing dogs over an 8 hr period, increasing the dose every few hours. Now the significant point is that an animal able to stand, say, a fourfold lethal amount of epinephrine shows no adaptation to its pharmacological action. The same small dose that initially caused vasoconstriction, change in heart rate, and so forth, still does so after adaptation. Apparently there are two different actions of the same drug in the same individual, one showing adaptation, and the other not.

A final particular item for comment has to do with the mechanism of action of various agents, the subject's reaction to the agent, the development of resistance, and so forth. What impressed me was that, one after another, the speakers outlined essentially the same list: Loomis for plants, L. E. Chadwick for insects, and Eddy and L. W. Law for man pointed to the same basic physical factors—penetration, absorption, spread, elimination—and the same chemical factors—inactivation of the agent by combination or degradation, inactivation of a particular enzyme by a change in the molecule, development of alternate metabolic paths so that the process can continue when the usual one has been blocked. Again, I could not help thinking that such common processes, common possibilities, appeared not only in the action of all sorts of agents on all sorts of organisms but also throughout biology. Exactly the same kind of problem arises in restitution, substitution, replacement, and elimination of all kinds. When the recovery of function, after a lesion has been made in the nervous system, is analyzed in terms of repair, or reeducation, or some other process, the same problems of the mechanisms of change appear in the same guise.

Yet, despite the intellectual satisfaction in seeing these likenesses over a wide range of phenomena and problems—indeed, the necessity of seeing them to achieve the basic orientation toward a problem that enables one to go forward in investigation—nonetheless, the real problems that have to be answered are always in terms of the particular facts in the particular case. It is fine to be able to interpret resistance in terms of changes in physical state, or changes in chemical state, or changes in enzymes; but one must finally specify which enzymes, which physical events, and so on, are the ones involved. It is only as these, often boring, technical details come into our ken and become a part of our armamentarium of knowledge that we can cope with the actual particular situation.

Flies develop resistance to DDT, by acquiring the hydrogen chloride-splitting enzyme of Kearns; in morphine habituation there may arise another enzyme, as already mentioned; chloretone and other narcotics may depress brain function by specific interference with carbohydrate metabolism or with phosphate generation, as argued between J. H. Quastel and W. D. McElroy; resistance to 8-azoguanine depends on the presence of a deaminase for this agent, as Law developed; DAB, the azo dye that generates liver carcinoma, is bound by specific proteins present in the liver, as J. A. and E. C. Millers reported, and the complex may be the carcinogen; the detailed interactions of genes and substrates, presented by H. K. Mitchell—such specific bits of fact enable their possessors to act intelligently in each particular case. So, although we certainly must paint the big picture, we must not forget that it, alone, will not take us far.

The last detailed point I refer to has to do with the question most vigorously discussed through the whole symposium: Is the development of resistance a matter of adaptation or of mutation, or is it a lingering modification somewhere in between? I kept score on the debate. There are 5 counts for adaptation; 3 clear-cut protagonists plus 4 halves, speakers "sort of on that side," as best I could judge. And there are 7½ for mutation; 5 clear-cut protagonists and 5 halves, not quite so clear. Two, I could not put in either category. This proves nothing, for the enthusiasm and the intensity of the adaptation protagonists more than overcame their weakness in numbers. They showed all the courage and the fighting qualities of the Scotch at Bannockburn and the Irish under any conditions!

Binding the Past

This brings me, then, to what seems especially important, the general problems that have come before us at this meeting. As I said at the beginning, we are, in effect, examining the problem of the interaction of two systems—or of a system and its environment, which still means two systems—in the course of time. Let me restate this in a number of different ways, to bring out some of the nuances and to make a few comments. Introducing a time factor inevitably brings up the possibility of change, the question of stability of the old and origination of the new. Saying this another way, it poses the whole problem of the storage of experiences by the system that has experienced them. We are asking, really, "How does process become pattern; how does a reversible disturbance become an irreversible state?"

I am tempted to talk at length on the record of a process left in a pattern, for I have had an exciting idea about it in recent months: When the formative processes are highly determinate the structures formed will be highly regular, and the greater the indeterminate, statistical, stochastic element in the processes, the more variable the resultant structures. Measurements, some of which are already in the literature, on the precision of repetition of structures should yield quantitative information on the degree of determinism in the underlying processes. The relationship between the mean and the variance of some structural attribute would show whether the processes were highly determined or highly chancy. As an example, compare the regularity of the hexagon in a honeycomb with the irregularity of the hexagons in squamous or cuboidal epithelium; or contrast the regularity of muscle fibers and fibrils in the longitudinal axis with their irregularity in cross section. It is interesting that the processes producing the honeycomb, though highly deterministic, are the actions of a group of individual organisms. But I must not pursue this theme now.

Another important question, which has kept bobbing up by inference, concerns the relationship between an individual as a complete entity, or *org* as I have sometimes called it, and that individual as a unit or member of some larger system, a group or a society or what I have called an *epiorganism*. This, also, I shall not go into, except to develop a bit the question of levels of organization—from the molecule or gene, through the organelle, the cell, the organ, the multicellular individual, the small group, the large group, the interbreeding population, or the social community, as the case may be. And, although this is repeating what others have said, I should like to restate it quite explicitly and to introduce this dimension of levels into our thinking.

Starting at the lowest level, a unit has its own past built into it in some set manner. This is now its heredity and is fully determined. What happens as a result of the behavior of the unit will depend, of course, on these inborn attributes and on the environment in which they operate. This is the point Mitchell made so fully with the *Neurospora* data. But just this activity of this subordinate unit in its environment forms substances or patterns that set the inherited character—or the given character, to avoid a word with other overtones—of the next higher unit. This new unit, in turn, reacts with its environment to determine a unit at the next level. So it is fallacious to place heredity at one locus and environment at another; a steady interaction between them occurs at each successive level.

For example, the protein molecule, with a given shape and side groups (the concrete entity that Sevag talked about, or that Pauling invoked to account for the production of a specific antibody, or even the interesting sickle cell anemia which apparently depends on an abnormal structure of the hemoglobin molecule) and depending on the medium in which it finds itself—what other proteins, what temperature, what pH, what substrates, and so on—will make certain other molecules. Now, whether it proceeds to make more of itself, in a general autocatalytic fashion, or whether it makes other molecules entirely, perhaps other enzymes, whether it reduplicates itself with some kind of spatial organization and makes only one replica, as in the template story, or whether it forms a mold against which an opposite kind of structural protein molecule will form—in other words, whether genes, or antibodies, or enzymes, or just other constituents or protoplasm are produced—will depend on the nature of that protein molecule and on the environment, the physicochemical medium, in which it is operating.

Once it has operated, there results a given cell organelle, say, with its fixed inheritance, with whatever it carries from its past history. The same thing recurs at the next level, whether it be a particular mitochondrium or microsome, whether plastids or plasma-genes are present, whether the killer factor in *Paramecium* is included or not, and so on. These then may multiply autocatalytically and reproduce themselves, either in more or less unregulated fashion or by rather sharp replication and with other associated properties of strict genic (cytogene) inheritance. E. D. DeLamater's pictures of bacterial structure came to mind here.

The whole cell is formed, in turn, by the action of these subordinate units and their environments; and the kind of cell produced is again determined by these given built-in components and their organization plus the environment in which it finds itself. Cells coming from a single dividing egg, with identical inherited genes, will form brain, or skin, or retina, depending on what other cells are near them; the endodermal anlage will form gut or liver, for example, depending on its proximity to an embryonic heart. This same situation occurs over and over again. Whether somatic mutations have occurred, which seems pretty clear in such cases as the pigment spots in piebald skin coloring or even the regular color patterns of feathers, or whether no mutation is involved, is perhaps not very important when looked at this way. Similarly for the cell foci which develop a lowered resistance—possibly favoring ultimate cancer development and certainly responding to chemical or other insult in their special way. Thus, a particular skin patch may redden and

desquamate each time a barbiturate is taken, although it is normally unidentifiable.

Moving to the organism level, from the fertilized egg to the newborn human baby is something like a 2^{43} increase in cell number; which means that more than 40 generations of cell division have occurred on the way from egg to baby. The attributes of the individual, of course, depend on the environments in which these cells multiply—at first intrauterine, which leads to congenital effects, but then those experienced on through life. Whether they are "inborn" skin ridges of fingerprints, or nail ridges produced by disease in the teens, or tree rings that show the climatic vicissitudes over a millenium, is not too important; all result from interaction of cell groups and their environment. It is often impossible to allocate the factors between cell or organ or organism levels, and to place their operation in time. For example, the aging process in multicellular organisms can be shown to be in the cells, since young ones grow faster in culture than do old ones, or in the body fluids, since young plasma promotes better growth than does old; yet the fluids are the collective product of the whole organism.

Finally, the same interaction pattern holds at the level of the epiorganism, or group. The kind of colony, the kind of population, the characteristics of the termite nest or of the metropolis and the culture that pervades it—these are the products of the organisms of which the epiorganism is composed, acting in their togetherness in response to the group environment and to their individual experiences during the formative period.

Perhaps this whole point is sufficiently made in the lovely couplet, "On Seeing Weather-beaten Trees":

> Is it with us as clearly shown
> By slant and twist, which way the wind hath blown?

Stability is obviously tremendous if a fertilized egg can go through 40 generations of cell division and come out an overwhelmingly stereotyped individual, billions upon billions of times. This must mean that enormously powerful homeostatic mechanisms operate at all levels: mechanisms for maintaining cell *p*H reasonably constant, for maintaining blood thyroxin reasonably constant, for maintaining hive temperature reasonably constant, and, no less, for maintaining cultural patterns of a group reasonably constant.

And there are no sharp discontinuities; from the perturbation or fluctuation, the reversible response to some environmental stress imposed upon the system and followed presumably by a full return to the *status quo ante*, there is a gradation to the modification, the irreversible material change. The phenomena present a spectrum, not a black or white dichotomy, and this I think is true even for the mechanisms. These are also not either-or. For example, one extreme is surely a gene mutation that, per se, gives a new phenotype. But then comes the gene mutation that enables the organism to show a new phenotype only when it is placed in some particular new environment, leaving it unchanged in the original environment. Here are the adaptive enzymes. Then comes a gene mutation that favors the appearance of other gene mutations in certain environments. Here the point is important that each gene is part of the environment of other genes. Next, there are genes that favor somatic mutations in multicellular organisms, and genes needed for adaptive enzymes to form in the presence of substrate. If such genes are lost by mutation, a strain of yeast, say, can continue to ferment galactose as long as the strain is cultured with galactose, but, once grown without this sugar, it can never recapture the ability to use it. This approaches the case of plasma particulates, with their complement of enzymes, which reduplicate or reproduce in a cell. The *Paramecium* killer factor and chlorophyll plastids come to mind as well as the example, presented by Mitchell, of cytochrome transmission in the breeding of molds. Next come cases of infection by viruses, carried along intracellularly during cell division and multiplication; of the intracellular HCl-splitting enzyme of DDT-resistant flies; of antibodies in tissue fluids of immunized multicellular organisms. We even find 2,4-D carried in the corn seed and inactive until germination and development produce the particular susceptible structure, kernel or silk, which is then mutilated.

At the behavioral level the same progression occurs from an early reversibility to a later irreversibility. Starting with repeated vasoconstrictions, spasms of smooth muscle of blood vessels stimulated to overactivity, there is the presumed sequence of hypertrophy, thickening, and finally calcification. A physiological contraction has become an irreversible constriction. It is clinically helpful, in cases of hypertension, to administer a drug, such as tetraethylammonium, that paralyzes the orthosympathetic constrictor nerves. If, when the impulses are blocked, a vasodilation results, it may be worth while to cut the nerves; but if the narrowing is no longer dependent on continued nerve excitation, surgical intervention will hardly help. Here the change from reversible to irreversible is very clear.

Irreversible changes can result, of course, from behavioral influences in relation to the external environment—the bowlegs of the cavalry man, the weathered skin of the outdoor person, even the reflection of an adult's temperament or character in the kind of skin folds in the face, whether frown or smile lines have become etched in. One example that has long intrigued me is the influence of alcohol and of mescaline on spiders. Under alcohol they weave their webs in an irregular fashion, as if the drunk were staggering home; under mescaline, which changes the time sense in human beings and apparently in spiders, a web is woven which is more perfect and with closer spirals than normal. Again, we see an irreversible structural manifestation resulting from transient and fully reversible physiological states.

The whole question of storage of experience, or memory, involves the same sequence from process to structure. Excellent neurophysiological evidence shows that memories in the brain, first in some dynamic form, require time to "set." Hamsters, given daily learning

runs through a maze and daily electroshocks, learn well enough when some hours elapse between run and shock, less well as the interval is reduced to an hour, and not at all when only a few minutes are allowed between experience and the disruptive shock. So something more than an hour is required for what is initially a passing ripple of nerve impulses to become solidified into a structural modification—whether chemical or morphological change at a synapse—of the nervous system. Conditioned reflexes, habits, are similarly fixed by repetition of a response to a recurring experience.

And I suggest that in the epiorganism of society the new idea is the cultural change, is something like the mutation or the adaptation we have been discussing. Several religions have in their records a description of a great flood. It has been interpreted by some as a folklore record of the inflow of the Atlantic into the Mediterranean basin. I have no idea how reasonable, theologically or geologically, this suggestion is; but I can cite a better proved instance of social fixation. An anthropologist noticed some years ago in a small Scandinavian village that the natives, going by a whitewashed brick wall, would make a small obeisance. There was nothing to be seen, and no one was able to suggest the reason for this local custom. He finally scraped off some of the whitewash and found underneath a religious painting, many centuries old. Obviously, in the past of that particular community there had been established the habit of making a little bow in passing this icon; and the bow persisted when even the object to which it was made was entirely forgotten.

When does one get an effective social mutation; what determines that a new idea "takes" in a community so that it becomes part of the culture? Maybe the word-of-mouth passage suffices in some cases even today; maybe now a written document is needed, or even a mass printing; or perhaps a nation-wide television program will suffice to imprint, with no direct record. But remember Don Marquis' poem about lost civilizations of the past:

> Their name? Go ask oblivion.
> They had no poet—and they died.

Cultural inheritance also passes from the evanescent word to the material record or ingrained attitude.

These fixations take time. There is a lag from the mutation to the phenotypic change, as Bryson pointed out. Williams spoke of the difficulty of inducing a vitamin deficiency in an adult animal that was well fed all its life, and Martin assured us that recently acquired racial characters fade out most easily. Similarly, recent individual memories are lost first, old learning being more stable than new, and even new learning requiring time to fix, as already mentioned. Races are almost annihilated by contact with new pathogenic organisms or drugs, but the great epidemics die out in time, and measles, for example, became a mild indisposition in populations that had long lived with it. The crucial point, of course, is: When does the system reach the point of no return; when has the reversible become the irreversible? Remember that the point of no return, even in modern aviation, is determined not only structurally, by the plane's position vis-a-vis the two continents, of origin and of destination, but also by dynamic factors, such as wind velocity and direction.

And since, as it has turned out, there is pretty good gradation in stability, in time, in mechanism, and maybe even in concepts, I again say there is no theoretical antinomy in the positions taken during this symposium. Each particular case has to be worked out on its own merits, in the light of experimental findings, to reach a useful result.

The Epochs of Man

It seems to me that one can think of three epochs in human affairs. Before the rise of biological science, man was pitting his own evolution as a biological entity, a very slow one, against the biological evolution of bacteria, insects, and other organisms that might be inimicable to him. Since they were moving faster in reproduction and modification than he, man was always getting the small end of the stick. Mankind was really ridden by pestilence and famine, by the horsemen of the Apocalypse; and Malthus was right not only in theory but in practice. A human's lot was not a happy one.

Then came the age of biological science, and we no longer had to pit biological mutations against biological mutations; we are now pitting social mutations of the human epiorganism, of man as a society, against the biological mutations of these other forms. And since social mutations, new ideas, give rapid evolution, and since science itself is a social mutagen that increases them, I feel reasonably confident that, however rapidly the organisms adapt or mutate into new and more virulent forms resistant to our existing agents, we will continue to find new means through our science, through our social evolution, of combating them effectively and keeping comfortably ahead.

The real problem, of course, is not any longer man against other organisms but man against himself. In social evolution, simpler natural science has grown more rapidly than social science and so has given a tremendous increase of power before the social organism has developed the coordinating homeostatic mechanisms necessary to control it. So we are now, all too clearly, in grave danger of wiping ourselves out. Here also, I have, if not confidence, at least hope that the further advance of the scientific mode—certainly not its abandonment—will solve these problems, too, before our brutish power destroys us.

Chicago Radiocarbon Dates V

W. F. Libby

Institute for Nuclear Studies and
Department of Chemistry, University of Chicago, Chicago, Illinois

THE dates obtained since the publication of our first four date lists (*1–5*) are presented in this report (*6*). This list covers the period from 1 Sept. 1953 to 1 Sept. 1954. The dates quoted are based on 5568 ± 30 yr as the half-life of radiocarbon (*3*). The number of runs is indicated by the number of dates listed, unless they were merely remeasurements of the carbon obtained from an earlier combustion, in which case brackets are placed around the dates involved. Remeasurement always involved rewashing the sample with acid for cleaning; otherwise, separate portions of the original sample were processed and measured. Counting time has been limited to 48 hr in general, except in the case of the samples on the Mayan Calendar problem (C-948 and C-949).

The numbering of samples and the file names we have used are entirely our own and not those of the donors and collaborators. The more descriptive names given by the donors are given first; our file names appear in parentheses. We prefix "C" to our numbers to distinguish them from the sample numbers from other laboratories.

RADIOCARBON DATES

Our No.	Sample	Age (yr)
I.	*Mesopotamia and Western Asia* (Principal collaborator: R. J. Braidwood)	
	A. *Egypt*	
C-811	*Nagada* (*Predynastic Hair II*): Human hair weighing about ⅔ oz found in a cemetery at Nagada in southern Egypt in 1896. This material belongs to predynastic Egypt and it is older than about 5,000 yr. The British archeologist W. Flinders Petrie constructed a scheme of what he called Sequence Dates on the basis of changing pottery styles, dividing the predynastic period into 80 Sequence Dates. About one-third of this sample consisted of material from Grave 1401 (Sequence Date 42), one-third from Grave 1863 (Sequence Date 46), one-third from Grave 1410 (Sequence Date 36 to 44), and a small amount (⅓ g) from Grave 1729 (Sequence Date 40). These samples as well as C-810, 812, 813, and 814 all came from Petrie's excavations at Nagada. They were taken from the Flinders Petrie Collection at University College. Submitted by Margaret Armit, Department of Archaeology and Ethnology, Cambridge University, England.	5619 ± 280
C-812	*Nagada II* (*Predynastic Hair III*): Human hair and skin from Grave T.56, dated by Elise Baumgartel generally as "Nagada II." Weight 45½ g including about 20 g of human skin. Submitted by Margaret Armit.	5020 ± 290
C-813	*Nagada II* (*Predynastic Hair IV*): Twenty grams of hair from Grave 733 (Sequence Date 58 to 67) and 5 g of hair from Grave 1349 (Sequence Date 58 to 67). Both portions were used. Submitted by Margaret Armit.	4720 ± 310
	C. *Iraq*	
C-744	*Jarmo* (*Jarmo Roman IV*): Jarmo is an early village site in the *tiwa* of Kirkuk, Irnq, midway between the towns of Kirkuk and Sulimaniyah. This site is early Neolithic and exhibits the earliest traces of an established food-producing village economy in the "nuclear" Near East. Only the upper third of the site yielded portable pottery, but there was a well-established architectural manifestation throughout the 7.10 m of depth, and there were traces of about a dozen "floors" or building renovations. An excavation labeled I was made clear to virgin soil near one edge of the mound. A second excavation, labeled II, was made from the highest point. This went down 4 m through the sixth floor, which is still 3.2 m above virgin soil. The sixth floor of II is equivalent to the third floor of I, and the second floor of II is equivalent to the first floor of I. The earlier Jarmo sample (C-113), consisting of shell, came from the seventh floor of I. It dated 6707 ± 320 yr. The present sam-	5266 ± 450

Our No.	Sample	Age (yr)
	ple, consisting of flecks of charcoal collected by the pickmen as they cleared the levels, came from J-II-2 and J-II-2nd floor. This material was high in the mound and near the surface. Collected and submitted by R. J. Braidwood, Oriental Institute, University of Chicago.	
C-817	*Tepe Gawra Ash* (*Tepe Gawra*): The sample of ash was taken from the trench face of the Tepe Gawra site in the spring of 1951 at a level 2 m above the apparent greatest depth in the low central operation. A fragmentary Ubaid painted jar was in contact with the hearth which yielded this ash. Compare Tobler, *Excavations at Tepe Gawra*, vol. II, pl. XVII–XIX. Level 19 is the deepest in the area; a point 2.0 m above this would fall above the floor of level 18, but certainly not higher than level 17. It is certain that the sample came from between floors 17 and 18. A date for this level would give the point at which the Ubaid period took on its first flourish in northern Iraq. This is of importance because the change involved was one from peasant villages to market towns with temples; it would lead to new understanding of the general rate of acceleration of cultural growth at a critical point. Collected and submitted by Mr. and Mrs. R. J. Braidwood.	[5552 ± 350 5100 ± 800] Average 5400 ± 325
	F. *Palestine*	
C-919	*Beer-Sheba* (*Beer-Sheba*): Charcoal from the lowest of three strata of a "chalcolithic" site at Khirbet el-Bitar, near Beer-Sheba, in Israel. The two overlying strata both contained architecture and there is no hint of intrusion. The sample was associated with potsherds, and Ben-Dor writes that "this culture is supposed to be akin to the so-called 'Ghassulian' culture of eastern Palestine." The "Ghassulian" is an assemblage for which dates have been assigned which vary over several thousand years. It would be a useful checkpoint, not only for our understanding of Palestine, but also in terms of the general comparative archeology of the Near East. Submitted by R. J. Braidwood.	7420 ± 520
II.	*Western Europe* (Principal collaborators: H. L. Movius, E. S. Deevey, Jr., and R. F. Flint).	

Our No.	Sample	Age (yr)
	D. *Ireland*	
C-877	*Irish Cooking Place* (*Irish I*): Samples of oak wood (*Quercus*) from an ancient Irish cooking place at Killeens, County Cork. This is site No. 1. Submitted by M. J. O'Kelly, Cork Publick Museum, Fitzgerald Park, Cork, and Eamon de Valera, Dublin.	3506 ± 230
C-878	*Irish Cooking Place* (*Irish II*): Oak wood as from an ancient Irish cooking place at Killeens, site No. 2. Submitted by M. J. O'Kelly and Eamon de Valera.	3713 ± 270
III.	*United States* (Principal collaborators: E. S. Deevey, Jr., R. F. Flint, J. B. Griffin, R. F. Heizer, F. Johnson, F. H. H. Roberts, and W. S. Webb).	
	A. *New England*	
C-809	*Titicut Site* (*Titicut*): Charcoal from a hearth from the lowest level at the Titicut site, Bridgewater, Mass. This was a hearth from the lowest level, found 36 in. below the surface of the ground. It is composed of pieces of charcoal, black sandy soil, and pebbles. The hearth was covered by a thin layer of brownish fine sand that was overlain by a layer of gravel and fine white sand about 8 in. thick. Above this there was a layer of yellow soil about 18 in. thick. Humus, the uppermost layer, covered the whole deposit. There was no sign of disturbance or occupation in the layers over the hearth. The distribution of the pebbles and the soil indicated that the layers called "yellow soil" and "gravel and fine white sand" had been deposited upon the hearth by natural movement of materials. The building and use of the hearth antedated this movement. The present hypothesis concerning this situation is that the soil layers were moved over the hearth by congeliturbation during a period when the climate was colder than at present. Continuing geologic investigations may modify this hypothesis. The hearth is covered by a deposit of natural origin. Various similar deposits found on this site and also a number of artifacts excavated from analogous locations are evidence of occupation previous to the movement of the materials. A date on the charcoal will contribute to our knowledge of the	[4139 ± 260 5750 ± 720] Average 4500 ± 300

Our No.	Sample	Age (yr)
	age of the occupation and the time when the geologic event responsbile for the movement of the materials took place. It is known that root hairs penetrate the pores of the charcoal. Collected 16 Oct. 1949 by J. Hartshorn, Kirk Bryan and Frederick Johnson. Submitted by Frederick Johnson, R. S. Peabody Foundation, Andover, Mass.	
	B. *New York State*	
C-943	*Sunken Forest in Eastchester, N.Y.* (*Pelham Bay*): At Throggs Neck, Eastchester, submerged tree stumps occur. There is a sea wall on one end behind a beach and a low rocky point terminating in a short pier on the other. A small patch of original Spartina salt-grass association some 30 ft long and 10 ft wide remains margined on one side by fill brought for a road and breaking off on the bayward side with a 2-ft bank of black peaty soil that is eroded by high tides during winter storms. At the foot of this perpendicular bank there are mussels and other maritime denizens. The sunken forest starts from about the mid-tide mark and extends out into 8 or 10 ft of water. The outermost stumps are not exposed even in the lowest tides. This sample came from a stump with cross-section diameters at ground level of about 1½ and 2½ ft. It scarcely protruded above the surface at low tide and its radiating roots had an over-all diameter of about 6 ft. It was about 6 ft below the level of the Spartina flat and about 4½ ft below the high tide mark. Submitted by William J. Robbins, New York Botanical Garden.	2830 ± 220
	C. *Illinois, Indiana, Iowa, Kentucky, Michigan, Ohio, Pennsylvania, and Kansas.*	
C-848	*Dune Buried Log, South Haven Mich.* (*South Haven I*): A white pine log taken from a layer of peat on the eastern shore of Lake Michigan at South Haven. The layer is covered by sand dunes. There was a 30-in. layer in which the bits of wood, the pine log constituting this sample, were buried. Collected and submitted by J. H. Zumberge, University of Michigan, and J. Harlen Bretz and Lee Horberg, University of Chicago.	6232 ± 310 6659 ± 350 Average 6440 ± 230
C-846	*Dune Buried Peat, South Haven Mich.* (*South Haven II*): The peat layer described in sample C-848 was sampled at the bottom portion. Submitted by J. H. Zumberge, J Harlen Bretz and Lee Horberg.	6744 ± 530
C-849	*Dune Buried Peat, South Haven Mich.* (*South Haven III*): Peat from the uppermost portion of the peat layer described in sample C-848. Submitted by J. H. Zumberge, J Harlen Bretz, and Lee Horberg.	4816 ± 290
C-871	*Glenwood* (*Glenwood II*): Wood from woody layer at the bottom of a sand and gravel deposit at Dyer, Ind., NE¼sec. 30, T35N, R15E, Ill. Taken at a depth of 12 ft below the top of the sand spit from the northernmost of the sand pits now opened. Same deposit as that from which sample C-801 was obtained. Collected 15 Sept. 1953 and submitted by J Harlen Bretz.	18,500 ± 500
C-872	*Dyer, Ind. Deposit* (*Glenwood III*): Peat from lagoon deposit buried beneath the Dyer spit where sample C-871 was obtained. Original depth of burial was about 15 ft. Collected and submitted 15 Sept. 1953, by J Harlen Bretz.	Older than 21,000
C-893	*Tazewell* (*Tazewell*): Log collected near central Ohio in Licking County, 4½ mi southwest of Newark, at a point 300 ft south of Ramp Creek and 500 ft east of the New York Central Railroad. This piece occurred 49 ft below the surface in an excavation for a hydraulic press of the Kaiser Aluminum Plant in 1952. At the surface are 5 to 15 ft of alluvial sand and gravel; below this is somewhat more than 60 ft of homogenous dark gray till. Twigs and a few logs were recovered from a depth of 45 to 60 ft. This till fills the mid-Pleistocene (Yarmouth?) buried Newark Valley known from wells 200 to 300 ft to bedrock. It is five mi west of the distinct outer limit of silty Wisconsin drift. On the other hand it lies five mi east of (outside) a clay-rich drift believed to be Cary (Johnstown moraine). All indications are that the logs were	16,100 ± 850

Our No.	Sample	Age (yr)

swept up and deposited by the Tazewell advance and that the surface was covered with thin outwash from the Johnstown moraine in Cary time. Excavated and submitted by Richard P. Goldthwait, Ohio State University.

C-899
C-900
C-903
C-904
C-904′
C-905
C-907
C-908

Barbeau Creek Rock Shelter (*Barbeau Creek I–IX*): The ancient Indian site located at Modoc near Prairie du Rocher, Ill., was investigated by a new field methodology. The site itself has considerable intrinsic interest. It consists of a 25½-ft deep midden deposit and is situated at the base of an 82-ft sandstone bluff that projects over and protects the site. It obviously belongs to the Archaic period and from an analysis of the artifacts it is clear that a great deal can be learned from this site about cultural change and development during the Archaic period. In addition, information about its age will be useful in establishing geologic and climatologic conditions in the area.

The samples to be measured were processed in the field by Frederick R. Matson of State College. The method used by Matson was new and was designed to facilitate collection of samples for dating from other sites. Four procedures were used:

1) A hand-picked specimen, using a spatula and shielding the palm of the hand with aluminum foil. This concentration of material from charcoal-rich soil is contaminated only with a thin coating of soil and possibly with rootlets that are prevalent throughout the site. There are calcareous deposits throughout the site to a slight extent.

2) Material washed in water. The charcoal that floated on top of the bucket of water was collected on a well-washed copper-wire screen (approximately 114-mesh) from a hardware store. After the sample was dried, the charcoal was placed on a piece of aluminum foil and fragments of rock and as many rootlets as possible were removed.

3) Material that passed through the copper screen mentioned above, but was retained on a 20-mesh and a 115-mesh sieve. This material was submitted only because of its general interest; it is contaminated with rootlets and rock fragments, and may not be of prime interest for measurement. The samples were saved, however, because at some sites the charcoal fragments may be no larger than these. It would be very tedious to separate all of the rock from the charcoal, but slight agitation in water effectively increases the charcoal content of the sample.

4) Samples collected in the field and untouched in the field laboratory. These jars have not been opened since they were taken from the excavation. They were submitted only to round out the possible series. It was not suggested that they be tested. They are charcoal-rich soils, and are similar to the material from which the samples obtained by procedure No. 1 were concentrated.

The site itself was divided into three stratigraphic zones.

Series A: 178 to 186 in. depth. The charcoal occurs in brown sandy soil within a few inches above ash beds and red burned clay areas that may have been hearths. This zone is particularly rich in flints and flint chips. A copper awl and a fragment of a ground and polished bannerstone were found. This is an important and fairly broad occupation zone.

Series B: 250 to 262 in. depth. This broad zone of charcoal-flecked soil is again just above ash levels and red clay hearth areas. Several pits and a few post holes reached from this level into the next lower one, which is a charcoal-free band of yellow sandy soil about 2 ft thick; it is practically free of cultural material and was built up in a series of bands which suggest varves. The zone just above this yellow soil from which the charcoal was collected was quite rich in cultural material. Apparently this marks the reoccupation of the site after a considerable period of sandy soil deposition (by water?).

Series C: 280 to 307 in. depth. This is the lowest occupation level found at the site. Test drilling at lower levels yielded no cultural debris. It is of course possible that further excavation of more extended areas would uncover occupation levels at greater depths, but at present there is no indication of this. Relatively few flint implements, but many flint chips, some worked, occur in this zone.

Our No.	Sample	Age (yr)
	The samples were furnished by H. D. Winters of the University of Chicago and Frederick R. Matson of State College, Pennsylvania. The notations in parentheses after each sample number indicate the zone from which, and the procedure by which the sample was taken. For example, the notation A-2 means that the sample was taken from zone A by procedure 2.	
	C-899 (A-1)	5955 ± 235
	C-900 (A-2)	5268 ± 230
	C-903 (B-1)	8546 ± 380
	C-904 (B-2)	10,947 ± 900
	C-904′ (B-2)	7800 ± 900
	C-905 (B-3)	11,200 ± 800
	C-907 (C-1)	10,651 ± 650
	C-908 (C-2)	9101 ± 440
C-912	*Lizard Creek* (*Lizard Creek I*): Wood presumably either of early Mankato or early Cary age from a deposit in Webster County, Iowa, 2½ mi northwest of Fort Dodge (SE corner SW¼ sec. 10, T89N, R29W). The stratigraphy is (i) 10 ft 4 in. calcareous Mankato outwash; (ii) 7 ft 4 in. calcareous Mankato till; (iii) 10 ft 0 in. calcareous outwash (early Mankato? or Cary?): wood from *oxidized calcareous bedded sand* 6½ ft below top of this outwash horizon, same stratigraphic level as sample C-913. (iv) 3 ft 7 in. calcareous till (early Mankato? or Cary?): exposed. Submitted by W. H. Scholtes and R. V. Ruhe, U.S. Department of Agriculture Soil Conservation Service, Iowa State College.	12,120 ± 530
C-913	*Lizard Creek* (*Lizard Creek II*): Wood from the same site as sample C-912 except it came from *unoxidized* portion of the glacial drift bed. The stratigraphy is (i) 10 ft 4 in. calcareous Mankato outwash; (ii) 7 ft 4 in. calcareous Mankato till; (iii) 10 ft 0 in. calcareous outwash (early Mankato? or Cary?): wood from *unoxidized calcareous bedded silt* 5 ft 10 in. to 7 ft 0 in. below top of this outwash horizon, same stratigraphic level as sample C-912. (iv) 3 ft 7 in. calcareous till (early Mankato? or Cary?): exposed. Submitted by W. H. Scholtes and R. V. Ruhe.	13,300 ± 900
C-923	*Toepfner Mound* (*Toepfner Mound I*): Charred logs from a tomb in a large Adena mound in Columbus, Ohio, known as the Toepfner Mound. These logs occurred 7½ ft above the floor of the mound. The sample was labeled Feature II. Submitted by R. S. Baby, Ohio State Museum, Columbus.	2377 ± 150
C-942	*Toepfner Mound* (*Toepfner Mound II*): Charcoal samples from the Toepfner Mound described in sample C-923. This material came from 4.4 ft above the floor of the mound. It was labeled Feature VII. Submitted by R. S. Baby.	2780 ± 410
C-874	*Florence Mound* (*Florence Mound*): Charcoal from an Adena mound known as the Florence Mound in Pickaway County, near Fox, Ohio. This consisted of charcoal from a ceremonial fireplace on the floor of the mound. Collected and submitted by R. S. Baby.	1425 ± 250
C-935	*Glacial Wood from Poag, Madison County, Ill.* (*Edwardsville Well Wood*): Wood from 70-ft depth in Edwardsville city water well at Poag. Location: NE¼NE¼SE¼ sec. 13, T4N, R9W. This well is located on a terrace that is probably late Mankato in age. Submitted by M. M. Leighton, Illinois Geological Survey.	Older than 21,600
C-937	*Glacial Wood from Hartford, Ill.* (*Hartford Well Wood*): Glacial wood thought to belong to the Mankato or to an older ice age found in a well at a depth of 100 to 110 ft, at Hartford, Madison County. Location: NE¼NE¼SW¼ sec. 33, T5N, R9W. The well, known as the Ranney collector well, was dug at the Shell Oil Co. loading dock at Hartford. Submitted by M. M. Leighton.	Older than 24,000
C-928	*Kansas Woodland* (*Kansas Woodland*): Wood charcoal collected from the Missouri basin in the course of the River Basin Survey's archeological excavation at the site near Woodruff, Phillips County, Kan. This site is representative of the sites of one of the early pottery making groups that has been estimated to have occupied the area somewhere between 1000 and 2000 yr ago. No remains belonging to that general period west of the Missouri River have been dated. The charcoal was found in a burial site attributed to the Keith focus of the Woodland pattern. The site has been re	1343 ± 240

RADIOCARBON DATES (*Continued*)

Our No.	Sample	Age (yr)
	ported by M. F. Kivett in a paper entitled "The Woodruff Ossuary, a prehistoric burial site in Phillips County, Kansas" (*U.S. Bur. Am. Ethnol. Bull.* 154, River Basin Surveys Paper No. 3, 1953). In Kivett's opinion, "the Keith focus probably represents one of the earliest Woodland variants in this area," perhaps preceding in time the Hopewellian culture of the lower Missouri-Illinois valleys. The Woodland materials of the Central Plains are not yet very well known. They evidently include the earliest pottery yet found in the region, and in part, at least, they may be prehorticultural. Unlike some of the later archeological horizons of the region, none of the Woodland complexes so far investigated have yielded any cross finds of southwestern pottery or other fairly good time indicators. In short, any chronological leads to be gotten from the present charcoal sample will probably throw much-needed light on a prehistoric period for which we have no good leads. Submitted by Frank H. H. Roberts, Jr., and Waldo R. Wedel, Smithsonian Institution.	
	E. *Louisiana, Mississippi, Missouri, Nebraska, Georgia, and Texas*	
C-824	*Medicine Creek Reservoir; Red Smoke Site (Red Smoke Site)*: Charcoal from the Red Smoke Site (Ft-42) in the Medicine Creek Reservoir Area, Frontier County, Neb. The charcoal was from a hearth in the middle portion of the Terrace-2A fill, located in sec. 15, T5N, R26W. See Schultz, Lueninghoener, and Frankforter, "A Graphic Resume of the Pleistocene of Nebraska," (*Bull. Univ. Neb. State Museum*, 3, No. 6, 1951) and Davis, *Am. Antiq.*, 18, No. 4, (1953). This sample was collected in 1950 by E. Mott Davis and associates. It bears the field No. UNSM 859-50. It would give a date which would be near to what is probably the climax of the Mankato. All of the samples from Terrace-2A which previously have been run are from lower levels. Submitted by C. B. Shultz, University of Nebraska State Museum.	[8570 ± 300 9153 ± 600] Average 8862 ± 230
C-930	*Cedar Canyon Charcoal (Cedar Canyon II)*: Charcoal from Sx-101, Cedar Canyon, Sioux County, Neb. In hearth associated with paleosol at base of Terrace-1 fill (15 ft below top of fill) in bottom of trench dug by University of Nebraska State Museum field party in 1936. This sample (collected in 1951 by Lloyd Tanner, Gilbert C. Lueninghoener, C. B. Schultz, and associates) gives an additional check on the date of the basal part of T-1 fill. The charcoal is from a paleosol below the place where sample C-469, which dated 2147 ± 150 yr, was taken in the same terrace fill and exposure. Submitted by C. B. Schultz.	2675 ± 280

RADIOCARBON DATES (*Continued*)

Our No.	Sample	Age (yr)
C-931	*Cedar Canyon Charcoal (Cedar Canyon III)*: Charcoal from Sx-101, Cedar Canyon, Sioux County, Neb. Sample associated with paleosol near top of Terrace-1 fill (25 in. below top of fill). This sample (collected in 1951 by Lloyd Tanner, Gilbert C. Lueninghoener, C. B. Schultz, and associates) is from a paleosol above the place where sample C-469 was taken in the same terrace fill and exposure. Submitted by C. B. Schultz.	3100 ± 410
C-933	*Booger Bottom Site (Booger Bottom)*: A site which is an erosional remnant of an old natural levee in Georgia. Indians had lived on the site, between floods, throughout its life. Site is located in the Buford Reservoir. Cultural material is quite homogenous from bottom to top. It represents a horizon found throughout the southeast. It shows some connections with the Adena culture of Ohio and Kentucky. No dates are available as yet on this horizon. Donor sample No. 53–131. Charcoal, Field Specimen No. 121. Site 9HL64 (Booger Bottom), Hall County, Georgia. Collected 30 Oct. 1953. From postmolds, Feature 16, Section 0–110, surface depth 8.2 to 8.7 ft in old natural levee. Associated with Cartersville Check Stamped pottery. Postholes originated in top of lowest occupation level. Material should date pure Cartersville Check Stamped horizon (Forsythe Period), and Wright Check Stamped horizon, which is present in some Adena mounds. Submitted by Charles H. Fairbanks, Ocmulgee National Monument.	2104 ± 140
	F. *Arizona, California, and New Mexico*	

Our No.	Sample	Age (yr)
C-689	***Hotchkiss site, Contra Costa County, Calif.*** **(*Hotchkiss*):** Charcoal from the Hotchkiss mound in Contra Costa County, (CCo-138). This was burial 18. This site, which falls in the Late Horizon, is an important prehistoric village and figures prominently in the archeological sequence. Collected and submitted by Robert F. Heizer, University of California.	1229 ± 200
C-894 C-895 C-896 C-897	***Searles Lake Mud*** **(*Searles Lake III, Searles Lake IV, Searles Lake V, Searles Lake VI*):** These materials came from Searles Lake, Calif. They consisted of organic extract from the mud which was obtained by extraction with acetone, evaporation to a thick syrup, and the precipitation of the resinous material by the addition of water. The descriptions are as follows:	
	C-894: extract representing the first foot of the parting mud seam between the upper and lower salt deposits of Searles Lake. This was taken at an average depth of 73.7 ft (73.2 to 74.2 ft). This sample should represent material deposited just prior to the last cessation of overflow of waters from the Owens Valley at the close of the last substage of the ice age (Tioga Age). Based on the accumulation of salines in Owens Lake since that time, this was estimated by the late Hoyt S. Gale (*U.S. Geol. Survey Bull.* 580-L, 1914) to be about 4000 yr ago.	10,494 ± 560
	C-895: material from the 3.5-ft level of the parting mud seam, 76.2 to 77.2 ft in depth.	15,089 ± 1000
	C-896: material from the 7-ft level of the parting mud seam, 79.7 to 80.7 ft in depth.	18,000 ± 730
	C-897; bottom 1 ft of the parting mud seam. Depth of 82.8 to 83.8 ft. This sample should correspond approximately with the sample C-615, which represented the bottom 2 ft of the parting mud seam in another location, and which gave an age greater than 16,000 yr. Submitted by W. A. Gale, American Potash and Chemical Co., Whittier, Calif.	23,923 ± 1800
C-898	***Guano from New Cave, Carlsbad Caverns*** **(*Carlsbad*):** Guano material from the New Cave, Carlsbad Caverns National Park, N.M. It comes from a compacted layer of guano occurring in the silt fill of New Cave, sec. 23T25S, R23E, New Mexico Bureau of Mines. The layer is about 2 ft below the flowstone cap forming the present floor of the cave about 100 yd within and 50 ft below the cave entrance. The associated silt contains numerous skeletal remains of an extinct species of three-tailed bat, *Tadarida*. Dating affords a maximum age for the beginning of the maximum dripstone and flowstone development in New Cave. This is believed to have been contemporaneous with the same stage in adjacent Carlsbad Caverns 5 mi east. Submitted by Lloyd C. Pray, California Institute of Technology.	Older than 17,800

Our No.	Sample	Age (yr)
	G. Nevada, Oregon, Utah, and Washington	
C-844	***Indian House Pit in Oregon (Klamath House)*:** Indian house pit on the Klamath Reservation, 18 m long on the north-south axis, 16 m wide on the east-west axis, and 2 m in depth. A dead ponderosa pine in the house pit, which started its growth sometime after the abandonment of the house, seems to have lived about 250 yr. Samples were wood taken from the house pit. Collected and submitted by L. S. Cressman, University of Oregon.	430 ± 165
C-728 C-729 C-730	***Lovelock Cave Basketry (Lovelock V)*:** Samples of basketry to check the cultural type found in the Lovelock Cave. Furnished by E. K. Burnett, Heye Foundation. Samples collected by Loud and Harrington and described in "Lovelock Cave" [*Univ. Calif. Publ. Archeol. Ethnol.* **25**, No. 1 (1929)]. Submitted by L. S. Cressman. C-728: matting fragment, 18 to 48 in. below the surface; C-729, Bulrush cud (*Scirpus validus*), 18 to 48 in. below the surface; C-730, basketry fragments, 18 to 48 in. below the surface. These three samples were combined.	1686 ± 220
C-735	***Lovelock Cave Basketry (Lovelock II)*:** Basketry fragments from a depth of 96 to 126 in. below the surface in the same cave as described in samples C-728, C-729, and C-730. Submitted by L. S. Cressman.	3172 ± 260
C-827	***Lind Coulee, Wash. (Lind Coulee)*:** Charcoal from an ancient occupation site in the Lind Coulee. In this site stone artifacts	[9400 ± 940 8518 ± 460] Average 8700 ± 400

Our No.	Sample	Age (yr)
	are found in association with animal bones in deposits that have been identified by geologists as Late Pleistocene in age. Among the bones from the site are those of bison. Because of the scrappy nature of the bones it has not been possible to identify the particular species of bison. The bones in general exhibit a fair degree of mineralization. Submitted by Richard Daugherty, State College of Washington.	
C-914	*Tule Springs Site, Tule Springs, Nev.* (*Tule Springs*): Ancient occupation site at Tule Springs. Excavated by Fenley Hunter and M. R. Harrington, Southwest Museum, Los Angeles. The sample consisted of charcoal taken from beneath one of the ash beds about 2 ft below the present surface and about 14 ft below the surface of the lake bed deposit which at one time covered it. It is thought that the charcoal is of human origin. Submitted by M. R. Harrington.	Older than 23,800
	H. *Minnesota, Wisconsin, and Wyoming*	
C-836	*Old Copper, Oconto, Wis.* (*Old Copper I*): Charred wood from the Old Copper culture site near Oconto. The samples were directly associated with Archaic burials. The Old Copper culture has never been accurately dated. Charred wood from crematorium Feature 1, Area II. Submitted by Robert E. Ritzenthaler, Milwaukee Public Museum.	5600 ± 600
C-837 C-839	*Old Copper, Oconto, Wis.* (*Old Copper II*): Charred wood from Feature 3, Area I constitutes samples C-837, and charcoal from Feature 11, Area I, constitutes sample C-839. Twelve grams of C-837 and 8 g of C-839 were mixed and measured. Submitted by Robert E. Ritzenthaler.	7510 ± 600
IV.	*Mexico and Central America*	
C-884	*Pre-Classic Miraflores, Kaminaljuyu, Guatemala* (*Guatemala I*): Charcoal from Str. 4, Md. E-III-3, Kaminaljuyu. This belongs to the pre-Classic Miraflores phase in this area. Collected and submitted by Edwin M. Shook, Carnegie Institution of Washington.	3142 ± 240

Our No.	Sample	Age (yr)
C-884	*Pre-Classic Majadas, Kaminaljuyu, Guatemala* (*Guatemala IV*): Charcoal from an intrusive cache of jades, pottery, and sculpture in Md. C-III-6, Kaminaljuyu. This belongs to the pre-Classic Majadas phase. Collected by Edwin M. Shook.	2970 ± 200
C-887	*Pre-Classic Miraflores, Kaminaljuyu, Guatemala* (*Guatemala III*): Charcoal from Str. 5, Md. E-III-3, Kaminaljuyu. Sample from the fill of Str. 5, stratigraphically slightly postdating C-884. Miraflores phase (formerly Verbena) of the pre-Classic. Collected by Edwin M. Shook.	2490 ± 300
C-891	*Pre-Classic Eruption in El Salvador* (*El Salvador*): Charcoal from San Salvador. Charcoal which serves to date the last pumice explosions of El Boqueron volcano and the pre-Classic artifacts (compare C-884, C-886, and C-887) found in abundance in the same stratum at many localities in and near San Salvador. This charcoal comes from a well ¼ mi north of the Inter-American highway bridge over Rio Acelhuate, approximately 1 mi east of San Salvador. It occurs in a layer of humus-bearing weathered pumice and is overlain by 31 m of fluviatile pumice. Collected and submitted by Howel Williams, University of California.	2993 ± 360
C-948 C-949	*Mayan* (*Mayan I, II*): In the case of these samples a second attempt to test the limit of sensitivity of the radiocarbon dating method was made. The first, published in the last date list (*5*), concerned samples from Nippur fixing the Babylonian calendar. The choice between the Spinden and Goodman-Thompson correlations for the Mayan calendar is the point at issue. In Nov. 1951 Kulp (*Science* **114**, 565) published a single result on wood taken from a carved Mayan lintel from structure 10, Tikal. The carved date on the lintel was 9.15.10.00 in the Mayan calendar, which, according to the Goodman-Thompson correlation, would be 30 June A.D. 741, and according to the Spinden correlation would be 30 Oct. A.D. 481. Kulp's result was A.D. 481 ± 120. The present samples from carved lintels from Tikal, Guatemala, were furnished from the Ethnographical Museum at Basel, Switzerland. Sample C-	

Our No.	Sample	Age (yr)
	948 was taken from the famous lintel shown on Plate 42 of Morley's *The Ancient Mayas*. It consisted of sapodilla wood and bore the Mayan date 9.15.10.00, the same as the sample tested at Columbia University. Sample C-949 was taken from the glyphic of the lintel shown on Plate 72 (Maudslay). It bore the same date and also was sapodilla wood. The samples were measured separately over a period of about 6 wk in each case, and the mean results calculated. Within the experimental error of about 1 percent the net count rate for both samples agreed. Combining these data with the half life of radiocarbon, which is estimated to involve an error of 0.54 percent, and the assay for modern wood, which we take to have an error of 0.67 percent, we obtain the results given. The samples were submitted by Hans Dietschy of the Ethnographical Museum, Basel. Most of the measurements were taken by Delia Gonzalez Tudge.	
	C-948: date, A.D. 469 ± 120.	1485 ± 120
	C-949: date, A.D. 433 ± 170	1521 ± 170
	Weighted average: date, A.D. 451 ± 110.	1503 ± 110
VII.	*Other Areas*	
C-829	*Situmpa Forest Station (Barotseland)*: Check pit excavated in 1952 by J. Desmond Clark of the Rhodes-Livingstone Museum, Livingstone, Northern Rhodesia. Charcoal from depth of 2 ft 10 in. to 3 ft 4 in. in redeposited Kalahari sands. Associated industry includes shards of Stamped Ware pottery (Bambata variant), which is not believed to be as old as would be indicated by the 4078 ± 300 yr (2126 B.C. ± 300 yr) obtained for sample C-662. This pit was dug at some 5 yd distance from the first excavation to check the earlier date. Submitted by H. L. Movius, Jr. on behalf of J. D. Clark.	1854 ± 220
C-830	*Lusu Village, Zambezi River (Lusu Village)*: Charcoal collected in what appeared to be a large hearth in Lusu Village, Zambezi River, Sesheke District Barotseland. Sample taken just above spot where shards of Stamped Ware pottery of a believed Rhodesian Wilton occupation were found. This is overlain by 2 ft 7 in. of redeposited Kalahari sands. The	[2025 ± 230 2353 ± 180] Average 2139 ± 150

RADIOCARBON DATES (*Continued*)

Our No.	Sample	Age (yr)
	section is very clear; the charcoal layer averages just over 1 in. thick and extends for 8 ft along the face of the section. Age believed to be approximately the same as that of the 4 to 5 ft horizon at the Situmpa Forest Station Pit, Machili (sample C-829). Submitted by H. L. Movius, Jr. on behalf of J. D. Clark.	
C-850	*Fossil Skull, Florisbad, South Africa (Florisbad I)*: Peat I from Florisbad site. The site lies approximately 25 mi due north of Bloemfontein, Orange Free State, Union of South Africa. The geologic stratification of this site is very marked. At a depth of 19 ft in the lowest peat layer, from which sample C-850 was taken, the Florisbad Skull, *Homo (Africanthropus) helmei*, was discovered *in situ* and in association with many stone implements and numerous extinct species of animals, for example, horse, hippopotamus, pig, and antelope. Above the lower-lying layer are three other layers of peat dated in later samples. Submitted by H. L. Movius, Jr. on behalf of A. C. Hoffman, National Museum, Bloemfontein, Union of South Africa.	Older than 41,000
C-851	*Florisbad Peat (Florisbad II)*: Peat II, lying 47 in. above the lowest lying peat (C-850), and itself 13 in. thick at the Florisbad site. Submitted by H. L. Movius, Jr. on behalf of A. C. Hoffman.	9104 ± 420
C-852	*Florisbad Peat (Florisbad III)*: Peat III, lying 52 in. above Peat II, which in turn lies 47 in. above the lowest lying Peat I at the Florisbad site. Submitted by H. L. Movius, Jr. on behalf of A. C. Hoffman.	6700 ± 500
C-924 C-925 C-926 C-927	*Cave of the Hearths, Potgietersrus, South Africa (South Africa I, South Africa II, South Africa III, South Africa IV)*: Organic material from the ashy substance constituting the deposit in the Cave of the Hearths, South Africa. Collected by R. J. Mason, submitted by K. P. Oakley, British Museum, London.	
	C-924: Middle Stone Age III: 130 in. in column "A"	11,600 ± 700
	C-925: Middle Stone Age IV; 180 in. in column "B"	15,100 ± 730
	C-926: Middle Stone Age II; 156 in. in column "A"	16,811 ± 960
	C-927: Middle Stone Age I; 288 in. in column "C"	11,700 ± 610

RADIOCARBON DATES (*Continued*)

Our No.	Sample	Age (yr)
C-911	*Bushman Paintings, South Africa* (*Bushman Paintings*): A very good sample of charcoal from South West Africa. It bears on a very important dating problem, namely, the question of the age of certain styles of the so-called Bushman paintings. The charcoal was found stratified in a cave deposit in direct association with ochre for making the frescos which fill the cave walls. H. Breuil is convinced that a measurement of these charcoals will provide a first direct indication of when the main group of these paintings was executed. The sample was collected at a locality known as the *Phillip Cave* which is near Ameib, southeast of the Erongo Mountains in the Windhoek region of South West Africa. Submitted by H. L. Movius, Jr., on behalf of H. Breuil, Paris.	3368 ± 200
C-917	*Zimbabwe, South Africa* (*Zimbabwe II*): Wood from an excavation in the "Temple" at Zimbabwe by K. R. Robinson in 1951 (See plan opposite p. 23 in Zimbabwe Guide). The specimen is cut from a second lintel, the first having already been dated at 1361 ± 120 yr (sample C-613). Sample submitted by Hallam L. Movius, Jr. on behalf of Roger Summers, National Museum, Bulawaya, Southern Rhodesia. This date was averaged with the date for sample C-613 of 1361 ± 120 to give a date of A.D. 574 ± 107 for the Zimbabwe city on the Christian calendar.	1506 ± 305
C-831 C-832	*Hawaii* (*Hawaii I and Hawaii II*): Charcoal and wood from Bowl Cave on uninhabited Necker Island, northwest Hawaiian Islands. Found in 1923 reportedly under 14 in. of sterile dust in association with stone artifacts of ancient Hawaiian type and thought to be contemporaneous with the ancient stone ruins on the island (see *Archeology of Nihoa and Necker*, Bishop Museum Bulletin 53, p. 90).	
	C-831: $1\frac{1}{16}$ oz charcoal stored in museum in tin can 1923–51, in glass jar, 1951–53. Collected by W. Anderson and submitted by Kenneth P. Emory, Bernice P. Bishop Museum, Honolulu.	166 ± 200
	C-832: $2\frac{1}{16}$ oz. piece of *wiliwili* (cork) wood, kept in cardboard box in museum.	0 ± 250

References and Notes

1. J. R. Arnold and W. F. Libby, *Science* **113**, 111 (1951).
2. W. F. Libby, *ibid.* **114**, 291 (1951).
3. ———, *Radiocarbon Dating* (Univ. of Chicago Press, Chicago, 1952).
4. ———, *Science* **116**, 673 (1952).
5. ———, *ibid.* **119**, 135 (1954).

6. I gratefully acknowledge the generous financial support of the John Simon Guggenheim Memorial Foundation, the Geological Society of America, and the Wenner-Gren Foundation for Anthropological Research. I also wish to thank the members of the Committee on Carbon 14 and the several other archeologists and geologists who have given advice about selection and identification of samples from time to time. Samuel Thomas, Augusto Moreno, and Delia Gonzalez Tudge burned and reduced the samples this year. Their meticulous care contributed immeasurably to the program.

News and Notes

Advances in International Conservation

The highly successful 4th general assembly of the International Union for the Protection of Nature was held in Copenhagen from 25 Aug. to 3 Sept. at the invitation of the Danish Government, which is a member of the union. Some 150 delegates and observers from 125 organizations and 25 countries participated; these representatives included zoologists, botanists, geographers, and soil specialists with a special interest in ecology as well as educators and officials from government departments concerned with conservation. Problems were presented in papers that were discussed in technical sessions or by special committees, the resulting recommendations were then reviewed by the executive board of the union, and final action was taken at the closing plenary session. The size of the assembly and the program arrangement made the meeting an effective working conference.

A technical meeting on the subject of the protection of arctic animals, presided over by Spärck, revealed an alarming decline in the numbers of many arctic species in recent years. Although some of this decline is due to natural conditions, such as climatic changes, there was clear evidence that man is also responsible because Indians and Eskimos have been furnished with modern rifles and motor boats. Modern transportation, especially the airplane, has made remote areas

much more accessible to human depradations. Such arctic marine mammals as the Greenland whale, the walrus, the polar bear, and the hooded seal have suffered greatly, and the preservation of some of these species is vital for the support of small native populations. Because many of these species, as well as some of the migratory birds that are endangered, are not restricted to the territorial waters of a single country, the problem of their future protection depends upon international cooperation. It was, therefore, decided that the union should establish a permanent Commission on Arctic Fauna to keep informed of the situation and to recommend appropriate action. The splendid work that has been carried out by Danish scientists in many parts of the world, and especially in East Greenland, makes it particularly appropriate that this new activity for the union should have originated at the Copenhagen assembly.

A second technical meeting was concerned with the effects of modern insecticides on mammals, birds, and insects. The papers delivered revealed that much research is now under way, and that extremely grave dangers result from the uncontrolled use of certain chemicals. The subsequent resolutions adopted by the assembly include the establishment of centers by governments to collect and correlate information on the effects of chemical control products on all wildlife, the expansion of research, the use of biological controls or cultural practices in preference to chemicals, and wider publicity to point out the dangers that result from the inconsiderate use of chemical control products. In connection with this last resolution, the union was asked to prepare a popular treatise on the dangers to fauna and flora from the misuse of chemicals.

Other subjects of vital importance to the future work of the union were discussed at special meetings. The one dealing with the population problem resulted in the unanimous adoption of the following resolution, which was forwarded to the World Population Conference that was taking place simultaneously in Rome:

> The IUPN being vitally concerned with the conservation for the benefit of future generations of the capital constituted by the natural resources, and consequently in the reasonable use of these resources, cannot remain indifferent to the rapid growth of human population. The increase of world food production hardly matches, if indeed it can continue to match, the increase of world population. Often, in spite of the efforts of experts, it achieves this only at the cost of an impoverishment of soil and water resources and a destruction of forests or of animal and plant communities and lastly of erosion affecting large regions of the earth.
>
> IUPN, therefore, sends to the World Population Congress, its best wishes for success, and urgently requests the participants of the World Population Congress, in their deliberations and conclusions to lose no opportunity of bringing to the notice of the responsible authorities the urgency of research and of action to deal with the closely connected problems of human population and of the natural resources available for its support.

A symposium on "Ecology and nature protection," organized by V. Westhoff of the Netherlands, was held on the day preceding the opening of the assembly. It included a number of significant papers pointing out that the maintenance of habitats, or biotic communities, should depend upon ecologic research, especially where rare plant and animal species are concerned. Both the UNESCO Technical Conference on the Protection of Nature at Lake Success in 1949 and the IUPN Technical Meeting at The Hague in 1951 had recommended ecological studies with special reference to human factors, and also a scientific study of landscape as it is increasingly affected by man. These recommendations, combined with another from the Copenhagen symposium, led to the establishment by the assembly of a permanent Commission on Ecology with a rotating membership of 12 persons under the presidency of J. Berry of Scotland.

The assembly also held meetings of its Commissions on Public Information and Education, the latter under the acting chairmanship of Laurence Palmer. A meeting of the Committee on the Survival Service reviewed the status of gravely threatened species of mammals and birds, and also approved the recommendation regarding plants that was proposed to the union by the 8th International Botanical Congress that was held recently in Paris. A new publication in French, entitled *Fossils of Tomorrow*, giving the latest information on the status of 12 seriously threatened mammal species, was issued, and recommendations were approved with reference to the Sumatran rhinoceros, the Arabian oryx, the Angolan giraffe, the Asiatic lion, and the Syrian and Nubian wild asses. The New Zealand Government was commended for its prompt action in protecting the rare (flightless rail) *Notornis*, and the Canadian Government was also commended for protecting the breeding grounds of the whooping crane.

The Peruvian delegate called the union's attention to proposed whaling operations off the west coast of South America, and the assembly adopted a resolution supporting the principles established by the International Whaling Commission for the Protection of Whales and condemned all violation of these principles. Among other resolutions approved by the assembly were those of the 1954 London Conference on Pollution of the Sea by Oil. Also approved was a recommendation emphasizing the need for continued scientific exploration of the marine resources of the world; this latter commended the research of the Danish Galathea expedition.

The union added some 20 organizations to its international membership. Among the newly elected officers were Roger Heim, director of the Museum of Natural History, Paris, as president, replacing J. Bernard of Switzerland; Lord Hurcomb of the United Kingdom and M. C. Bloemers of the Netherlands as vice presidents; and H. Gams of Austria, V. Van Straelen of Belgium, J. G. Baer of Switzerland, and Richard Westwood of the United States as members of the executive board. An invitation to hold the 5th assem-

bly in Edinburgh in 1956 was unanimously accepted.

All who attended the meetings were impressed by the hospitality that was extended by our Danish hosts, which included a memorable dinner given by the Prime Minister, a reception at the Frederiksberg Town Hall, and a luncheon at the Carlsberg Brewery. There were also field trips to Southern Sealand and the Island of Mon, as well as to protected heaths, game reserves, and bird sanctuaries in central and western Jutland. All the activities were well organized by the Naturfredningsraadet.

In addition to a new appreciation of Denmark, each delegate returned to his country with a realization of the extensive work that has already been accomplished by the IUPN, of the need for further strengthening it through new members, and of the necessity for having continued support from UNESCO and, if possible, from FAO, as well as from private and government sources in the countries that are most concerned with the union's program. Unfortunately there is much confusion about the term *protection of nature,* which is much more widely understood in its basic concept in Europe than it is in the United States. In the constitution of the union it is defined as "the conservation and wise use of the entire world biotic community or man's natural environment which includes the earth's renewable natural resources of which it is comprised and on which rests the foundation of human civilization."

The union's activity in furthering conservation is well documented in the published reports of its meetings during the past 6 yr, and the base line for future work, as well as a recent inventory of the reserves and legislation in most countries, is set forth in its two-volume publication on *The Present Status of Nature Protection throughout the World.* The union's education, information, and research activities stem from its special commissions, and also depend in large measure upon the ever-active central secretariat of the IUPN, which is located at 42, Rue Montoyer, Brussels, where further information is always available.

HAROLD J. COOLIDGE, *Executive Director*
Pacific Science Board, National Research Council

Recent Progress in Hormone Research

The annual Laurentian Hormone Conference was held 5–10 Sept. at Mont Tremblant, Quebec, Canada. Fourteen papers were presented. The general subjects considered included the pituitary hormones, steroid chemistry and biochemistry, hormones and abnormal growth, hormones and aging in man, mechanisms of hormone action, and hormone-cardiovascular interrelationships.

The pituitary hormones were discussed in the initial sessions. H. B. van Dyke described the chemical structures, synthesis, and bioassay of the posterior pituitary hormones. M. Sonenberg summarized his studies on the fate of thyroid-stimulating hormone, prolactin, somatotropin, and gonadotropin labeled with I^{131} or S^{35}. The present concepts of the mechanisms of stimulation of corticotropin secretion were critically analyzed by P. Munson, who presented data indicating that morphine blocked the release of corticotropin from the pituitary. R. Hertz described the effects of "Amphenone-B" upon the structure and function of the adrenal cortex. Administration of this compound caused hypertrophy of the thyroids and adrenal cortices of rats, but inhibited the synthesis of adrenal steroids.

Recent developments in the field of steroid biochemistry were reviewed by J. Fried and S. A. Simpson, and by J. F. Tait. Fried described the oxidation of steroids by microorganisms and reported on the biological activities of the 9-halogenated derivatives of hydrocortisone and cortisone. Tait outlined the methods used for the isolation and identification of aldosterone (electrocortin). He pointed out that aldosterone differs from most other adrenal steroids in that it (i) possesses an aldehyde group at C^{13}, (ii) has an extremely high sodium-retention potency, (iii) has a very small concentration in normal adrenal venous blood, and (iv) appears to be little, if at all, under the control of corticotropin.

Jacob Furth described the methods of induction of transplantable pituitary tumors and presented data indicating that these neoplasms synthesize anterior lobe hormones. The endocrinology of human neoplastic growths was discussed by R. Rawson, who reviewed the results of the treatment of human carcinomas by castration, by adrenalectomy, and by the administration of steroid hormones and of I^{131}.

A description of the histologic and functional aging of the human testis and ovary was presented by E. T. Engle. Later G. Pincus presented studies of the urine of men and women to illustrate the variations of steroid excretion with age. Discussion of these papers revealed that, although human gonadal aging processes are now well documented, the relationship of these changes to general somatic aging remains obscure.

The mechanisms of hormone action in carbohydrate metabolism were considered in papers by R. Levine and B. Hastings. The former investigator presented data indicating that insulin controls the entry of glucose into the cell. Hastings discussed the effects of potassium and of various endocrinological disorders on the carbohydrate metabolism of surviving liver slices, and he supported the view that insulin influences intracellular enzyme systems.

The final sessions were devoted to hormone-cardiovascular interrelationships. J. Stamler reviewed the fields of experimental atherosclerosis and hypertension and discussed the relationship of nutrition to human cardiovascular disease. E. Shorr described his investigations of VEM and VDM, outlined the identification of VDM with ferritin, and commented on the role of VEM and VDM in circulatory homeostasis.

All these significant papers, as well as the thought-provoking and lively discussions, are to be published in volume 11 of *Recent Progress in Hormone Research.*

ROBERT C. BAHN
National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Bethesda, Maryland

Science News

Kathleen Lonsdale, fellow of the Royal Society, professor of chemistry and head of the department of crystallography at University College, London, and chairman of the editorial board for *International Tables for X-Ray Crystallography*, wrote the following letter concerning **U.S. visa policies.** It was published in the 7 Oct. issue of the *Washington Post and Times Herald*.

I have, during the two preceding months, undertaken a lecture tour in India, Japan, Australia, New Zealand and Canada, visiting Hongkong, Bangkok and Singapore en route. As I am a woman, a scientist and a Quaker, with some concern for the right exercise of democratic civilian responsibilities, I have enjoyed considerable opportunities of observing conditions and assessing political trends in general, and in scientific and religious circles in particular, during this time, short though it was.

I think it might have been of interest to many American citizens to have heard my report, and I would like to have given it. When I applied in London for a United States visa, however, one month before my intended departure for Asia, I found that I was expected to supply a list, with dates, of all organizations of any kind to which I had belonged since December 31, 1918. I began with the Royal Society of London and the Religious Society of Friends, but as the list grew longer and longer, two conclusions forced themselves upon me: firstly, that no matter how hard I tried, I would not be able to produce an honest and complete list, since, like all people in public affairs, I must have belonged to dozens, if not hundreds, of organizations; secondly, that my desire to enter the U.S.A. would not sustain me for long enough to make the effort. I therefore altered my itinerary to pass through Canada instead of the U.S.A.

Even so, however, it was apparently necessary for me to spend one night in transit through Honolulu. Since I had no United States visa, but only a transit permit issued in Australia, I found that I was regarded as a dangerous alien; my British passport was removed, as were those of other Commonwealth citizens, and I was informed in print that I would be allowed no visitors and no telephone conversations. Fortunately the absurdity of the latter prohibitions, which I was quite prepared to observe, resulted in their being completely ignored by all the United States citizens in Honolulu, and their friendliness did a little to dispel the general dislike and contempt of United States official immaturity that was otherwise being forced upon me.

Is it too much to hope that the people of the United States will wake up soon to the fact that they are less likely to keep out their enemies by the means they now adopt than to lose their friends?

Another letter, which appeared in the *Friend* (London) for 1 Oct. under the heading "Five Months' Wait for a Visa," was written by Mildred Creak of the department of psychological medicine, Hospital for Sick Children, London, who is at present touring child guidance clinics in the United States.

A good many Friends knew that I had difficulty obtaining a visa to visit the U.S.A. for professional visits following the Fifth International Congress for Mental Health, which has recently been held in Toronto, and to which I went as a delegate and to give a paper.

Knowing that the U.S.S.R. visa and visit of 1951 would certainly be something of an obstacle, I made early application, actually on March 20. When I sailed for Canada on July 23 I had still had no answer, one way or the other, in spite of many visits to the visa department of the United States Embassy, cables, and all the help my medical and Quaker friends could give me. I had still heard nothing when the Conference ended in Toronto, four weeks later. . . .

Exactly five months to the day after I had applied for it, and only two days late for my arranged tour of visits to clinics in the U.S.A., the visa came. . . .

It would be easy to capitalise the indignation of my friends on both sides of the Atlantic during the period of uncertainty. Indeed, quite often in that five months, I felt myself as if I had walked into an Edgar Wallace novel without learning my part. It is easy to see that cumbersome methods of investigation will lead to these fantastic delays. In the absence of guilt, the *proof* of innocence is a formidable task. It seemed obscure to me that I was "investigated" without my taking part, since I had nothing to conceal. But it was a situation in which the active exercise of patience and good will was a necessity, and I was determined not to add any stones to the wall of misunderstanding which already exists between English and American thought and practice. I am, therefore, glad of this opportunity to let my friends know that I have a visa and am in the U.S.A.

The Department of the Interior has announced that, according to the September records of the Geological Survey, a **drought of major proportions** comparable to the one experienced in the early 1930's is building up in the southern and central states. Ground-water levels, stream flow, and reservoir levels are at or near record low levels throughout the southern two-thirds of the United States. Many communities and farms are short of water and some utilities and industries have been affected. The moderate floods that occurred in the northeast as a result of hurricane Edna did not appreciably alter the situation.

It is generally held that the land vertebrates arose from crossopterygian fishes. These fishes comprise two groups, Rhipidistia and Coelacanthini. The Rhipidistia, which first appear in the Middle Devonian and disappear in the Lower Permian, are the more primitive in structure and it is from them that the land vertebrates are believed to have been derived. The Coelacanthini apparently evolved from rhipidistians in the Upper Devonian and persisted relatively unaltered until near the end of the Cretaceous, when they disappear from the fossil record.

The crossopterygians were therefore thought to have been extinct since the time of the dinosaurs, a matter of some 70 million yr. Hence the taking of a living **coelacanth,** *Latimeria*, off the east coast of South Africa in 1939 was an event of prime importance. Unfortunately this specimen was incompletely preserved and its internal anatomy could not be studied. In recent years, however, some half-dozen addi-

tional specimens have been caught, five of them off the Comoro Islands, west of northern Madagascar. In a recent number of *Nature* [174, 426 (4 Sept. 1954)], J. Millot reports some new observations on the anatomy of the soft parts of these "living fossils." Hitherto, indications of crossopterygian soft-part structure have been gleaned only indirectly, from the living lung-fish or Dipnoi. These, although closely related to the crossopterygians, and presumably retaining many ancestral crossopterygian characters, nevertheless obviously are highly and peculiarly specialized. Knowledge of actual coelacanth soft-part anatomy is thus of great importance. It should be realized, however, that the coelacanths themselves are highly specialized fishes almost certainly far removed in many details from the early crossopterygians from which the land vertebrates appear to have been derived.

There is a vestige of a pulmonary organ. The remarkably wide esophagus passes over into the stomach fundus without macroscopic differentiation, there being no cardia; the transition can be distinguished only histologically. The capacious stomach is V-shaped, with a short dorsal limb and a long ventral limb that forms a tubular pylorus which opens into a short chamber suggesting the bursa entiana of other fishes. This chamber passes directly into a spiral intestine, there being no cecal appendage. Beyond this is the hind-gut, comprising a rectum and a cloacal pouch bearing a urinogenital papilla posteriorly. An unpaired serous-type nodular gland, probably homologous to the selachian digitiform gland, empties into the cloaca. The liver has two lobes; the hepatic cells contain much fat but considerably less than in many sharks. There is a large gall bladder and a well-developed pancreas. The kidneys are fused into a single median organ located, most unusually, on the ventral abdominal wall behind the cloacal opening; the testes, however, are dorsal and precloacal. There are paired ureters, urinary bladders, and urethrae. The kidney has large glomeruli and well-developed Malpighian tubules; its structure, however, appears complicated and peculiar. Unlike that of many teleosts, it contains no lymphoid tissue but has considerable infiltrations of pseudoeosinophilic leucocytes. The extreme abundance of these cells, their intense and diffuse hemopoiesis, and their penetrating ensheathment of the abdominal organs, appears to be a histological peculiarity of coelacanths.

With Cousteau, Millot has discovered that modern coelacanths inhabit very steeply sloping basalt rocky bottoms around the Comoros, at least 200 to 400 m deep. Inasmuch as there is no adult female among the five specimens caught off the Comoros, Millot believes that their range may extend below 400 m. It has been hypothesized that the coelacanths live in submarine upwellings of fresh water that occur off Grand Comoro. Since it is indicated that coelacanths in past geologic times have lived for long periods in brackish or nearly fresh water, it has been suggested that they have been able to survive because the fresh-water upwellings have provided them with their ancestral environment at depths where there is reduced competition. Millot points out that this hypothesis seems untenable, however, not only because the upwellings seem to occur in the intertidal zone but because samples of sea water from off Anjouan, where the coelacanths were captured, show quite normal marine salinities. In this connection it may be noted by way of addendum that paleontologic evidence indicates that whereas coelacanths originally were fresh-water forms, they apparently became marine dwellers in the Triassic, the Jurassic and Cretaceous species being salt-water forms. Hence there seems to be no need to postulate a fresh-water environment to explain their survival to the present day. Their possession of large renal glomeruli, as reported by Millot, is scarcely to be expected in a salt-water fish, however, unless the coelacanth has evolved some mechanism for retaining body water analagous to, if not homologous to, the urea contrivance of elasmobranchs.—W. L. S., Jr.

Secondary school science teachers have been added to the draft board list of those in critical occupations who may be exempted from military service. Heretofore only college teachers with a master's degree or better have been on the list, and the losses of urgently needed high school science teachers have been large.

A letter from C. W. Hart, Jr., that appeared in the 15 Oct. issue of *Science* reported the capture of a shark, ***Squalus acanthias***, in the Appomattox River at a point that is 120 air mi from the Atlantic Ocean. This puzzling find has been explained by the following paragraph in a recent issue of the Washington, D.C., *Evening Star* which stated that, according to the Richmond, Va., *Times-Dispatch*,

> . . . Doug Jackson of Farmville was given the shark while visiting Virginia Beach. He brought it home packed in ice, but his fondness for it dwindled and he dumped it into the river, thinking turtles would destroy it.

A Swiss patent that may well have been the first practical design of a nuclear reactor has been reported in a recent issue of *Nucleonics*. The patent dates back to 1939, only 5 mo after the discovery of fission and 3 yr before the first reactor was built in the United States. The National Center for Scientific Research in Paris applied for the Swiss patent on 19 Apr. 1940; it was granted 30 June 1944, with a priority to 1 May 1939. After the German invasion of France in 1940, there was no development of the proposed reactor and information on the plan remained classified. The patent is another indication that the United States has had no monopoly of ideas about reactors, even during the infancy of atomic energy work.

The inventors found that a light substance arranged near the fissioning uranium would slow the emitted fast neutrons so that they would cause more fissions in a chain-reacting process. By proper arrangement of materials, a continuous chain reaction could be established. The patent notes that the reaction could be controlled to produce usable heat energy.

According to the article, the reactor described consists of 36 long compartments, each containing six 5.9-in. cubic iron-nickel boxes. Spaces between cubes and compartments are occupied by uranium slabs. An inert gas circulates in the fuel chamber to prevent oxidation of the uranium. A heavy-water moderator acts as coolant; it is circulated through the boxes to heat exchangers, from which it is pumped back to the core. High-pressure normal water picks up heat in the exchangers and transfers the energy to turbines. A neutron source located in the core's center aids in starting the reactor. Control mechanisms consist of electrically rotated rods upon which sheet-metal disks are mounted. Sectors of the disks are covered with neutron-absorbing cadmium. Rotation of the rods controls the power level by inserting varying amounts of cadmium between the core compartment walls.

The patent application also describes alternate materials and configurations. Either uranium or thorium, or a mixture of both (as solid, liquid, gas, or compound) could be used as fuel. The document also mentions the need for fission-product removal and refueling, and states that radiations from the core have many applications, particularly in medicine.

An expedition to the Marshall Islands headed by Bruce Halstead, head of the department of biotoxicology in the School of Tropical and Preventive Medicine, College of Medical Evangelists, left 19 Sept. Halstead and 10 members of the department will collect specimens of **poisonous fish** that will be frozen for return to the college. The expedition is being sponsored by the U.S. Public Health Service and the Atomic Energy Commission.

Not so long ago hormones were supposed to be the exclusive possession of vertebrate animals. Plant hormones entered the picture in 1925 and were isolated and chemically characterized a few years later. The hormones of invertebrate animals resisted discovery somewhat longer, but in 1928 the control of pigmentation through the expansion and contraction of chromatophores was shown to depend in crustaceans on a hormone derived from the eyestalks. Wigglesworth proved, by means of classic experiments performed during the early 1930's, that molting in insects, and also pupation, is controlled by hormones, but the chemical nature of these has remained unknown until recently. A. Butenandt and P. Karlson, working at the University of Tübingen, have succeeded in **crystallizing the first insect hormone,** that which is secreted by the prothoracic glands and brings about metamorphosis from the larval stage to the pupal.

The story of this isolation has been told in articles in *Z. Naturforsch.* [9b, 389 (1954)] and *Naturwiss. Rundschau* [7, 355 (Sept. 1954)], the latter being a semitechnical account. The raw material for the isolation consisted of 1 million silkworm pupae, which required a large portion of the annual German production of silkworms and a tremendous amount of hand labor in removing the pupae from the cocoons. From this raw material, amounting to 500 kg of fresh pupae, some 25 mg of crystalline hormone was eventually obtained. Of this purified stuff 0.0075 γ is sufficient for a Calliphora-unit, that is, the amount needed to make a single isolated abdomen of the blowfly *Calliphora* transform from the pupal state to that of the adult fly; and 10 to 12 γ are sufficient to transform the isolated abdomens of the large saturniid Cecropia and Cynthia moths from the pupal forms to the adult. Chemically the pupation-hormone is of great interest, for it contains no nitrogen. Although its chemical structure remains to be determined, the ultraviolet-absorption spectrums indicate that it is a hydroaromatic alcohol with an α,β-unsaturated keto group. It is thus a type of substance that has not heretofore been found in the realm of hormones.—B. G.

A new device for determining differences in **smelling sensitivity** has been developed by Nowell F. Jones, psychologist at the University of California in Los Angeles. The instrument is helping to correlate individual differences in smelling sensitivity with the chemical facts known about certain odorous compounds. The device sends controlled "whiffs" of various materials, some pleasant and some unpleasant, toward a subject's nose. By this means it is hoped to establish definite relationships between the molecular characteristics of certain substances and the ability of individuals to discern their odor.

Scientists in the News

A team of three American doctors headed by **John F. Enders** of Harvard University has won the 1954 Nobel prize for physiology and medicine. The others in the group were **Thomas H. Weller,** also of Harvard, and **Frederick C. Robbins** of Western Reserve Medical School. The men were honored "for their discovery of the ability of the poliomyelitis virus to grow in cultures of different tissues." This opened the way for production of polio vaccine, and also made it possible for doctors to establish quickly and easily whether or not a person has become immune to polio by having contracted it in a mild form sometime during his lifetime. The group's tissue culture technique established a new landmark in medical history. Since it was first announced in 1949, it has become one of the most effective research techniques in the search for a means to eradicate not only polio, but a host of other virus infections such as virus pneumonia, acute respiratory disease, influenza, and the common cold.

This year each award will be $35,066, the highest amount in the 54 yr of Nobel prize history. The members of this winning group will receive $11,688 apiece; all will be invited to Stockholm for King Gustaf Adolf's presentation of the awards on 10 Dec.

John F. Bishop of Beckman Instruments, Inc., has been appointed general manager of the Beckman Division.

Science regrets to announce the resignation of **Walter J. Nickerson** from the editorial board. In July Dr. Nickerson was promoted to professor of microbiology and member of the new Institute of Microbiology at Rutgers University. With his increased responsibilities, he feels that it would be difficult for him to continue in the editorial post that he has filled so ably for the past 2 yr.

John C. Snyder, professor and head of the department of microbiology at Harvard University since 1946, is the new dean of the School of Public Health. He succeeds the late Brig. Gen. James S. Simmons, U.S.A. (ret.), who died during the summer.

Rudolph A. Peters, of the Institute of Animal Physiology, Babraham Hall, Cambridge, England, and until recently professor of biochemistry at the University of Oxford, will give the 10th course of lectures under the Charles E. Dohme Memorial Foundation on 9 and 10 Nov. at the Johns Hopkins Hospital, Baltimore. His subject will be "Present state of knowledge of the biochemical lesions induced by trivalent arsenicals" and "Some recent work in the field of fluoroacetate compounds."

Peters retired at the end of the past academic year from the Whitley professorship of biochemistry at Oxford, a post he had held since 1923. While there he built up a school of dynamic biochemistry and found the first clue to the mode of action of thiamine from a study of its *in vitro* effects on metabolic processes. He has earned knighthood and many other distinctions for his achievements. He was elected a fellow of the Royal Society in 1935, received a Royal medal in 1949, and delivered the Croonian lecture in 1951. He has held many lectureships, including the Dunham lectureship at Harvard College.

The 6th annual Friend E. Clark lectures at West Virginia University, sponsored by Tau Chapter of Phi Lambda Upsilon, will be given on 16 and 17 Nov. by **Joel H. Hildebrand,** who will talk on "How scientists think and work" and "Liquids and solutions." The series has been established in honor of **Friend E. Clark,** professor emeritus of chemistry who was head of the department from 1919 to 1947.

Robert Balk has been appointed visiting professor of structural geology at California Institute of Technology for the fall quarter. Balk is on leave of absence from the State Bureau of Mines and Mineral Resources, Socorro, N. Mex., where he has been principal geologist since 1952.

V. K. Zworykin, television pioneer and inventor, was recently the guest of honor at a scientific seminar and dinner in Princeton, N.J., given by the Radio Corporation of America to mark his retirement as vice-president and technical consultant, RCA Laboratories, and his appointment as the first honorary vice president in the corporation's history. David Sarnoff, chairman of the board of RCA, was principal speaker at the dinner. The seminar's theme was "Thirty years' progress in science and technology." The participants and their subjects were as follows: Hugh Taylor of Princeton University, synthetic materials; I. I. Rabi of Columbia University, nuclear physics; Jerome C. Hunsaker of Massachusetts Institute of Technology, aeronautical developments; and James Hillier of Melpar, Inc., medical electronics. Irving Wolff of RCA Laboratories was the moderator.

Zworykin received his degree of electrical engineer from the University of Petrograd in 1912 and then conducted research at the Collège de France in Paris. After wartime service with the Signal Corps of the Russian Army in World War I, he came to the United States and acquired his American citizenship. He received the Ph.D. degree at the University of Pittsburgh in 1926. He worked on the research staff of the Westinghouse Electric Corp. before joining RCA in 1930.

Zworykin's scientific achievements include invention of the iconoscope and kinescope. He also directed the development of the electron microscope. In World War II Zworykin served on the Scientific Advisory Board to the commanding general of the U.S. Army Air Forces, on the Ordnance Advisory Committee on Guided Missiles, and on three subcommittees of the National Defense Research Committee. He also directed research in aircraft fire control, infrared image tubes for "sniperscopes" and "snooperscopes," television guided missiles, storage tubes, and radar systems. In recognition of his war work, he was awarded the Navy certificate of commendation, the Presidential certificate of merit, and the War Department certificate of appreciation. For his peacetime contributions Zworykin has received many awards both here and abroad, one of the most recent of which was the 1951 medal of honor of the Institute of Radio Engineers.

Charles D. Thomas has been promoted to acting head of the department of physics at West Virginia University, succeeding **R. C. Colwell,** who retired on 30 June. Thomas first joined the university staff in 1931 and has served as professor of physics since 1947. He also serves as head of the radiological division of the West Virginia civil defense organization and has conducted research on radioactivity detection devices.

Cyril L. Comar has joined the staff of the medical division of the Oak Ridge Institute of Nuclear Studies as principal scientist. He resigned his post as laboratory director of the University of Tennessee-Atomic Energy Comission Agricultural Research Program in Oak Ridge to accept his present appointment.

Marvin Camras, senior physicist at Armour Research Foundation of Illinois Institute of Technology, will receive from the City of Philadelphia the John Scott award for scientific achievement. He will receive the award—consisting of $1000, a copper medal, and a scroll—for his discoveries and subsequent improve-

ments in magnetic recording. His inventions currently are used in radio broadcasting, motion pictures, home entertainment, office dictation, memory units for high speed electronic computers, instrumentation, guided missiles, and others.

American Society of Horticultural Science awards for the best papers in their respective areas appearing in ASHS *Proceedings* for the year 1953 are as follows.

Leonard H. Vaughan award in floriculture and ornamental horticulture: **James B. Shanks** and **Conrad B. Link** of the department of horticulture, University of Maryland.

Leonard H. Vaughan award in vegetable crops: **R. W. Richardson** of the Rockefeller Foundation, Mexico City; **T. M. Currence** of the department of horticulture, University of Minnesota.

Joseph Harvey Gourley award in pomology: **J. R. Shay** of the department of botany and plant pathology, Purdue University; **D. F. Dayton** of the department of horticulture, University of Illinois; **L. F. Hough** of the department of horticulture, Rutgers University.

Alex Laurie award in floriculture and ornamental horticulture: **Charles A. Lewis** of Northport, L.I., N.Y.

Charles G. Woodbury award in raw products research: **F. W. Allen** of the department of pomology, University of California, Davis.

Foster D. Snell, Inc., New York, has announced two staff appointments. **Seymour M. Barer,** formerly with the Chemical Plants Division, Blaw Knox Co., is a chemical engineer in the engineering department. As a project engineer, he will be engaged in plant design and process engineering.

Willard R. Crandall, for 25 yr chief chemist for M. Ewing Fox Co., Inc., is a chemist in the product development department where he will supervise a research and development program in polymer emulsion paints.

Twelve men from diverse fields of science were recognized by the Franklin Institute of the State of Pennsylvania at its annual Medal Day ceremonies on 20 Oct. Guest speaker and recipient of the Franklin medal, highest honor awarded by the institute, was **C. E. Kenneth Mees,** vice president in charge of research at the Eastman Kodak Co., Rochester, N.Y. The medal, awarded annually to the scientist considered to have "done most to advance a knowledge of physical science or its application," was presented to Mees "For his many outstanding contributions to the scientific knowledge of the photographic process and for his development of the first organized scientific laboratory in the United States which resulted in new products advancing the usefulness of the photographic process and increasing its artistic acceptance."

A John Price Wetherill medal, awarded for discovery or invention in the physical sciences, was given to **William D. Buckingham** of the Western Union Telegraph Co. for his invention of the zirconium concentrated-arc lamp. This is a direct current lamp, made with permanently fixed electrodes sealed into a glass bulb filled with an inert gas. The lamp concentrates the arc activity to produce a fixed, high-intensity light source.

Edwin T. Lorig, chief development engineer of the U.S. Steel Corp. also received a John Price Wetherill medal for his invention of the Lorig-Aligner, a type of self-centering roll used in the rolling of steel strip and tin plate. His invention has resulted in the manufacture of a better product at a higher rate of speed and with less spoilage.

Clarence N. Hickman, research consultant of Jackson Heights, N.Y., was the recipient of another John Price Wetherill medal "In consideration of his inventions in rocketry, in telephony, in sound-recording, in archery and in other fields."

C. Levon Eksergian, executive engineer of the Budd Co., was awarded the George R. Henderson medal "In recognition of his invention and subsequent intensive development and application of the Disk Brake as applied to both self-propelled and high speed passenger cars in railroad service. . . ."

A Francis J. Clamer medal was presented to **William Justin Kroll** of Corvallis, Ore., "In consideration of his invention of a method adaptable to the large scale production of cold malleable commercially pure titanium and zirconium."

Two men in the fluorescent lighting field were given Frank P. Brown medals "In consideration of their outstanding contribution by the development of the fundamental concept of the fluorescent electric lamp, with the accompanying benefits of high efficiency, low heat output and wide color selection." These men are **Hans J. Spanner,** consultant in electrical engineering of Zurich, Switzerland, and **Edmund Germer,** consultant physicist of Irvington, N.J.

A Frank P. Brown medal was awarded to **Humboldt W. Leverenz,** director of the Physical and Chemical Research Laboratory, RCA Laboratories, Princeton, N.J., for his contributions to the development of the fluorescent lamp, principally by the invention of reliable, efficient, and versatile phosphors.

For his achievements in communication, **Kenneth Alva Norton,** chief of the radio propagation engineering division, National Bureau of Standards, was the recipient of a Stuart Ballantine medal. He was honored "In consideration of his contributions over a period of twenty-five years in the field of radio propagation through which our knowledge has been considerably increased by his measurements; our insight broadened by his theoretical work; our engineering calculations made easier by his charts and our broadcasting frequency allocations above 50 m.c. established more effectively through his guidance."

For their outstanding paper on the "Mechanical design of muscle-operated arm prosthesis," **Alfred C. Blaschke** of the Douglas Aircraft Co. and **Craig L. Taylor,** professor of engineering at the University of California, were recipients of Louis E. Levy medals.

F. Newton Hayes of the Los Alamos Scientific Laboratory and an authority on the physical and chemical properties of liquid phosphors recently visited the department of internal medicine at Yale University. He delivered a talk on the "Mechanics and applications of organic scintillation detection" before a mixed group of chemists, physicists, and physicians.

Howard S. Turner, director of the research and development division of Pittsburgh-Consolidation Coal Co. since 1948, has been named vice president for research and development of Jones and Laughlin Steel Corp. He succeeds **H. W. Graham,** who becomes consultant on technology. **Harold T. Clark,** assistant director of research, has been made director of research.

The Society of Motion Picture and Television Engineers has named **Ray D. Kell,** a member of the television research staff of the RCA Laboratories Division of the Radio Corporation of America, recipient of the 1954 David Sarnoff gold medal award for his pioneering achievements in the development of all-electronic television and for his contributions to color television, including its adaptation to the limits of a 6-megacycle channel.

The Office of International Relations, National Academy of Sciences–National Research Council, has provided the following information concerning the travel plans of **scientific visitors** to the United States:

S. J. Folley, National Institute for Research in Dairying, Agricultural Research Council, Edinburgh. Arrived 20 Oct. for approximately 5 wk. Will be the guest of the Henry Ford Hospital in Detroit, where he will attend an international symposium on *The Hypophyseal Growth Hormone, Its Nature and Actions.*

R. D. Passey, Chester Beatty Research Institute, Royal Cancer Hospital, London. Arrived 28 Sept. Will visit research centers to survey clinical experiment work on lung cancer on behalf of the Medical Research Council's Biological Working Committee on the Chemistry of Tobacco Smoke in Relation to Carcinogenesis.

D. J. Short, Medical Research Council, London. Here from 27 Nov. to 15 Dec. Will participate in the Animal Care Panel meeting at the University of Chicago, 1–2 Dec. Will visit experimental animal houses, principally in industrial research organizations, in the New York and Chicago areas.

A. W. Taylor, Rothamsted Experimental Station, Agricultural Research Council, England. Here 1 Oct. for 2 yr on a postdoctoral fellowship in the Department of Soils, University of Wisconsin.

Ralph M. Hixon of Iowa State College, who has made significant contributions to both farming and industry in the Middle West through his research in agricultural chemistry, has been chosen to receive the 1954 Midwest award of the American Chemical Society's St. Louis Section. Studies directed by Hixon helped this country meet its need for starch when imports dwindled during World War II. Starch is important not only for food purposes, but for such industrial products as explosives, adhesives, laundering agents, and medicines. Hixon and his colleagues helped to develop the production of starch from a variety of corn known as waxy maize. The production of this starch is now a multimillion dollar business.

Sidney M. Fox, formerly of the Panelyte Division of the St. Regis Paper Co., has joined the Lederle Laboratories Division, American Cyanamid Co., as a chemist in the chemical production section.

Robert E. Hopkins, professor of optics at the University of Rochester, has been promoted to director of the university's Institute of Optics, founded in 1930. He succeeds **Brian O'Brien,** director since 1938, who has been on leave to serve as vice-president in charge of research for the American Optical Co. at Southbridge, Mass. O'Brien has resigned from the Rochester faculty to continue his work with American Optical, but he will retain his post on the advisory committee of the institute.

LaVerne R. Philpott, former chief scientist for the Balco Research Laboratory, Newark, N.J., and holder of a Presidential citation for his contribution to the development of the first successful American radar system, has been appointed a coordinator in the research division of New York University's College of Engineering. He will direct basic research that will include studies fundamental to air navigation and scientific photography.

Ralph S. Heath, for the past 6 yr a civil engineer for the engineering division of the Atomic Energy Commission's Chicago operations office, retired on 31 Aug. after 47 yr of state and federal government service. He finished high school at Detroit Central (now Wayne University), and in 1903 entered the University of Michigan, from which he graduated with a degree in civil engineering. His first regular assignment in his long engineering career was with the district office of the U.S. Corps of Engineers as a surveyor on the Cumberland River Project at Nashville, Tenn., in 1907. Other assignments included the Detroit River improvement project and the development of the Great Lakes Naval Training Station from 1909 to 1919. He superintended some construction both at Pearl Harbor and at the Norfolk Navy Yard; then from 1920 to 1933 he served with the Illinois Division of Waterways. He was transferred to the St. Paul District, U.S. Army Corps of Engineers, in 1933 and placed in charge of construction of eight locks and dams on the Upper Mississippi River.

From 1938 to 1942 Heath was area engineer on the Williamsport, Pennsylvania Flood Control Project before going to the Pennsylvania Ordnance Works in the same capacity; there he was assigned as chief of the contract section under K. D. Nichols, now general manager of the U.S. Atomic Energy Commission. In the fall of 1943, Heath was transferred to the Man-

hattan Engineering District, predecessor of the U.S. Atomic Energy Commission, and stationed at Oak Ridge as supervisor and reviewer of contracts on the K-25 Project (Gaseous Diffusion Plant). On his final day of duty the Atomic Energy Commission presented Heath with a certificate of appreciation "For Faithful and Meritorious Service."

Donald Bricland has become director of the Elizabeth McCormick Memorial Fund, 155 E. Ohio St., Chicago 11, Ill. The McCormick Fund, established in 1908 by Mr. and Mrs. Cyrus H. McCormick, is concerned with research in child development and welfare.

The following appointments to assistant professor have been announced. Tulane University: **H. Marshall Dixon,** physics. University of Cincinnati: **Hans H. Jaffe,** chemistry.

Necrology

Raymond F. Bacon, 74, chemical engineer, author, developer of important processes in the petroleum, sulfur, and allied industries and in the hydrogenation of vegetable oils, and former director of the Mellon Institute for Industrial Research, Philadelphia, Pa., 14 Oct.; **James G. Carr,** 78, former chief of the medical staff of Evanston Hospital and professor emeritus of medicine of the Northwestern University Medical School, Evanston, Ill., 17 Oct.; **Lewis G. Cole,** 80, roentgenologist and investigator of lung dust lesions, White Plains, N.Y., 15 Oct.; **G. P. Douglas,** 62, aerodynamics expert and pioneer of the wind tunnel, Camberley, England, 16 Oct.; **Paul S. Egbert,** 59, chief of civil engineering for the Strategic Air Command's installations division, Omaha, Neb., 13 Oct.; **William L. Evans,** 83, past president of the American Chemical Society, researcher in carbohydrates, author, and professor emeritus of chemistry at Ohio State University, Columbus, Ohio, 18 Oct.

Howard Fox, 81, research dermatologist, author, former editor of the *Archives of Dermatology and Syphilology,* and former professor of dermatology at New York University College of Medicine, New York, N.Y., 19 Oct.; **Martin Friedrich,** 52, specialist in internal medicine and hematology, founder of the Gerald Friedrich Leukemia Research Foundation at the Jewish Hospital, Brooklyn, N.Y., 18 Oct.; **Katharine W. Harris,** 54, dietitian and head of the department of institution management in the College of Home Economics at Cornell University, Ithaca, N.Y., 19 Oct.; **Lewis P. Hobart,** 81, architect and expert in Mexican archeology and art, San Francisco, Calif., 19 Oct.; **Richard E. Holmes,** 46, chief engineer of the air-conditioning and refrigeration division in the Holyoke, Mass., branch of the Worthington Corp., 15 Oct.; **Frederick J. Kasper, Sr.,** 64, fuel engineer with the Eastern Gas and Fuel Associates, Philadelphia, Pa., 19 Oct.; **Frederick W. Kressman,** 66, research chemist and vice president of the Continental Turpentine and Rosin Corp., Laurel, Miss., 1 Oct.; **David Kuperstein,** 53, gynecologist, obstetrician, and former instructor at the Long Island College of Medicine, Brooklyn, N.Y., 19 Oct.

Arthur G. McCall, 79, soil scientist, former president of the American Society of Agronomy, former professor of geology and soils at the University of Maryland, and consultant with the Agriculture Department's Soil Conservation Service, Olney, Md., 19 Oct.; **Jackson R. Schonberg,** 56, staff engineer in the Esso engineering department of the Standard Oil Development Co., Linden, N.J., 19 Oct.; **Henry F. Smyth, Sr.,** 78, pioneer in the field of industrial hygiene research, professor emeritus of industrial medicine at the University of Pennsylvania, and director of the Smyth Laboratories, Philadelphia, Pa., 15 Oct.; **Frederic A. Snyder,** 81, civil engineer, former instructor in military topography and field engineering at McGill University, and safety engineer for the New York Board of Water Supply, New York, 19 Oct.; **William H. Stewart,** 86, past president of the American Roentgen Ray Society and former clinical professor of radiology at Columbia University, New York, 12 Oct.; **Leo R. Tehon,** 59, botanist with the Illinois State Natural History Survey and professor of plant pathology at the University of Illinois, Urbana, Ill., 17 Oct.; **Boris I. Zbarsky,** professor of biochemistry at the First Moscow Medical Institute, Russia, 15 Oct.

Meetings

The **AAAS Lancaster Branch** will hold meetings on the first Thursday of each month from Nov. 1954 through Mar. 1955. Attendance at these meetings, which are held at Franklin and Marshall College, ranges from 680 to 800 persons.

The 3rd **U.S. National Congress of Applied Mechanics** will be held at Brown University 11–14 June 1958. It is hoped that the scheduling of conflicting meetings can be avoided by this early announcement. Inquiries regarding the congress should be addressed to one of the following members of the organizing committee at Brown University, Providence 12, R.I.: Prof. D. C. Drucker, secretary; Prof. E. H. Lee, treasurer; Prof. W. Prager, chairman.

The **Utah Academy of Sciences, Arts and Letters** will meet at Weber College, 19–20 Nov.

More than 1000 physicians and surgeons from 33 countries attended the 3rd **International Congress of Internal Medicine** in Stockholm, 15–18 Sept. It was opened by Nanna Svartz of Sweden, president. Hypertension and collagen diseases were the two main subjects. A large group of U.S. scientists were present. Paul Klemperer of Mount Sinai Hospital in New York questioned the prevalent theory that arthritis, rheumatic fever, and kindred diseases are caused by allergies. Philip S. Hench of the Mayo Clinic and 1950 Nobel prize winner for his codiscovery of cortisone,

gave a lecture on the revolutionizing uses of this suprarenal hormone as well as of the hypophysical hormone ACTH, especially against collagen diseases. Another Nobel prize winner, Corneille Heymans of Belgium, submitted new theories about the reasons for high blood pressure. He reported that research conducted at the Veterinary College in Stockholm by Yngve Zotterman and his associates has confirmed his theory that the blood pressure is affected by reactions within the carotid artery. The next congress will be held in Madrid in 1956.

At the **Congress of the International Committee on Photobiology** held in Amsterdam, 23–28 Aug., the Niels Finsen medal was awarded to William W. Coblentz in recognition of his research on the biological action of light. Because Coblentz could not be present in Amsterdam, the presentation of the medal was made on 21 Oct. at the National Bureau of Standards by Alexander Hollaender of the Oak Ridge National Laboratory, new president of the committee. The new secretary is W. Burckhardt of Zurich. The next congress is scheduled to take place in Turin, Italy, in 1957.

The 3rd general assembly of the **International Union of Crystallography** was held in Paris, 21–28 July. Delegates from the U.S. were Lawrence O. Brockway, chairman, of the University of Michigan; Arthur L. Patterson of the Institute for Cancer Research, Philadelphia; Bertram E. Warren of Massachusetts Institute of Technology; Ralph W. G. Wyckoff of the division of physical biology at the National Institutes of Health and currently scientific attaché, American Embassy, London; and William H. Zachariasen of the University of Chicago. At the present time 18 countries are represented in the union.

The major items considered by the assembly were: (i) reports of commissions and joint commissions; (ii) election of commissions and of representatives on other bodies, and determination of their terms of reference; (iii) election of an advisory board for *Acta Crystallographica*, a bimonthly periodical; (iv) clarification of the position and powers of delegates and alternates; (v) consideration of the publication of a list of crystallographers of the world, including their addresses and major fields of interest; and (vi) discussion of general policy and time table for the period to the next general assembly.

Education

Rice Institute at Houston, Texas, has established a new department of geology that will emphasize fundamental study and research. Specific work in geology will begin in the third year, after a thorough background in mathematics, physics and chemistry. Only relatively small numbers of students will be admitted. The new division was made possible through a gift from Mrs. Olga Keith Wiess that established a chair in geology as a memorial to her late husband.

A long-range program in **cancer education** has been initiated at the Medical School on the Los Angeles campus of the University of California. The project is being supported by a yearly grant of $25,000 from the U.S. Public Health Service. Emphasis will be on teaching of the latest cancer diagnostic and therapeutic techniques to medical students. Patients whom the students will observe will benefit from these techniques and at the same time the additional clinical material furnished by the program will aid research. Justin Stein, professor of radiology, will coordinate the program. All departments will participate since the cancer problem covers all phases of medicine.

The **University of Pennsylvania's** new animal research center, an adjunct to the university's School of Veterinary Medicine, has been formally dedicated. Known as New Bolton Center, it is located in Chester County, which is one of the richest agricultural areas in southeastern Pennsylvania.

One of the features of the dedication program was the initial showing of a plaque set up in recognition of the gifts and services of heirs of the late Effingham B. Morris, Philadelphia financier, to veterinary education at the university.

Massachusetts Institute of Technology has announced plans for building the **Karl Taylor Compton Laboratories for Nuclear Science and Electronics** as a memorial to the institute's late chairman. The $3,000,000 laboratory will be dedicated to fundamental research that will exploit the peacetime potential of electronic and nuclear science. A fund of $3,000,000 will be provided for unrestricted support of work in these fields. The M.I.T. nuclear reactor, which is to be devoted solely to education and to nonsecret and peacetime research, will also be associated with the Compton Laboratories.

Available Fellowships and Awards

University faculty members are invited to apply for places in the **Oak Ridge research participation program** carried out by Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies. Through this program, faculty members may conduct research in Oak Ridge for periods of from 3 mo to 1 yr. Oak Ridge National Laboratory is the principal center of research, although limited opportunities for participation also exist in the University of Tennessee–Atomic Energy Commission agricultural research program and in the medical and special training divisions of the Institute.

Oak Ridge National Laboratory offers opportunities for fundamental and applied research in physics, chemistry, metallurgy, biology, mathematics, and engineering, with a number of nuclear reactors and particle accelerators as the principal research instruments. The UT–AEC agricultural research program is concerned with the internal and external effects of radiation on farm animals. The Institute's medical division

conducts extensive studies of the internal and external uses of radioisotopes in cancer treatment, and studies in radiation physics; the special training division carries on research in instrumentation, radioisotope applications, and the occurrence of radioactivity in ores and sea water.

Payment while a person is on leave for research participation approximates his university salary. Application should be made 6 mo in advance of the time when the applicant expects to begin his Oak Ridge research. Additional information may be obtained from the University Relations Division, Oak Ridge Institute of Nuclear Studies, Box 117, Oak Ridge, Tenn.

The National Academy of Sciences–National Research Council has announced the inauguration of a new program of National Research Council–National Bureau of Standards postdoctoral research **associateships in chemistry, mathematics, and physics** for the academic year 1955–56. These associateships have been designed to provide young investigators of unusual ability and promise an opportunity for basic research in the following fields: pure and applied mathematics, applied mathematical statistics, numerical analysis, experimental thermodynamics and calorimetry, statistical mechanics, molecular structure and spectroscopy, low temperature physics, solid state physics, theoretical and nuclear physics, radiological physics, analytical chemistry, inorganic chemistry, and physical chemistry.

These fellowships are open only to citizens of the United States. Applicants must produce evidence of training in one of the foregoing fields equivalent to that represented by the Ph.D. or Sc.D. degree and must have demonstrated superior ability for creative research. *Applications must be filed on or before 10 Dec.* Awards will be made about 1 Apr. 1955. Further information may be secured for any of the programs by writing to the Fellowship Office, National Research Council, 2101 Constitution Ave. NW, Washington 25, D.C.

Grants and Fellowships Awarded

The **American Academy of Arts and Sciences** has recently announced the following research awards from (i) the Permanent Science Fund, 6 grants totaling $7030, and (ii) the Rumford Fund, one grant of $500.

J. H. Boyer, Tulane University. Axlactones from the reaction of aldehydes on azides.

R. S. MacNeish, National Museum of Canada. Development of agriculture and concomitant development of 'high culture' in southwest Tamaulipas, Mexico.

R. S. Miller, Harvard University. Population growth and competition in *Drosophila*.

R. L. Reid, University of New Zealand. Behavior of several species of organisms, particularly concerning the relationships between motivational conditions and the activation of habits.

M. D. Taylor, Howard University. Vapor phase dissociation of some carboxylic acids, III. Trifluoracetic acids.

H. B. Washburn, Museum of Science, Boston. Mount McKinley, Alaska, Map.

G. G. Holz, Jr., Syracuse University. For the purchase of a spectrophotometer and associated glassware to be used in measuring turbidity of protozoan suspensions and in spectrophotometric chemical analyses.

The following **Damon Runyon Memorial Fund** grants for cancer research, totaling $137,760, were awarded in September:

Columbia University. College of Physicians and Surgeons. Alfred Gellhorn, $12,000.

Memorial Center, Sloan-Kettering Institute. J. S. Laughlin and J. J. Nickson. The role of high energy radiation in cancer patients, $20,000.

New York University. Morris H. Harnly, $8900.

University of Oregon. T. B. Fitzpatrick, A. B. Lerner, and H. S. Mason. The detection, metabolic control, and therapy of malignant melanomas, $20,000.

Roswell Park Memorial Institute, Buffalo, N.Y. Theodore S. Hausohka, $10,300.

Hitchcock Foundation, Hanover, N.H. M. Dawson Tyson, $4700.

Chicago Medical School. Philippe Shubik, $4860.

Scientific Specialties Corp., Boston. The purchase of a color translating ultraviolet microscope, $7500.

Fellowships

Louis Wolfe, New York. Cancer research in Europe, $6000.

Julian Van Lancker, University of Wisconsin; George Fruhman, New York University; Jean-Gabriel LaFontaine, Memorial Center; Anand P. Chaudhry, University of Minnesota; and Marie B. Sorenson, Children's Cancer Research Foundation, Boston.

Fellowship renewals

Ulrich Naf, New York; Chiyeko Okawa, Oak Ridge, Tenn.; Henri Isler, Montreal; Joseph V. Landeau, New York; and Spyridon Allvisatos, New York.

Seventy-nine corporations and one foundation provided educational assistance to **Rensselaer Polytechnic Institute** during the fiscal year 1953–54. The total value of the aid given by these organizations amounted to $167,239. Of this amount, $68,826 was in unrestricted gifts from 24 companies. Thirty-four companies contributed gifts of equipment valued in excess of $32,000. Thirteen companies donated scholarships valued at $23,378; and six companies provided fellowships to the amount of $17,200. The National Science Foundation and two corporations made grants-in-aid valued at $25,800 to five research programs.

This assistance was in addition to $200,000 contributed by 105 companies in support of two sessions of the Industrial Council, an extracurricular educational program arranged by the institute under policy guidance from representatives of industry. The council's objective is to create a greater understanding of the economic and social philosophies under which we live.

The School of Chemical Technology at the **North Dakota Agricultural College**, Fargo, has recently received additional research and fellowship grants. The latest award of $4800 was provided by Spencer Kellogg and Sons, Inc., of Buffalo, N.Y. This sum will be paid over a period of 4 yr, and will be used to subsidize the research activities of a graduate student working in the field of drying oil technology; in addition, one or two senior students may be awarded $300 to $450 annually.

The Archer-Daniels-Midland Co., of Minneapolis, Minn. has again renewed its two grants of $1250, one for an undergraduate and the other for a graduate in chemistry.

Instruments and Equipment

Readings of linear dimensions, radii, and angles in places where obstructions prevent the use of contact measuring devices can be obtained with a new direct-reading **erect-image microscope.** The instrument is designed to utilize a pocket comparator of any make—the comparator can be set in place and locked with one adjustment. Thus one or more comparators with varied reticle patterns can be used. Linear dimensions are given in both inches and millimeters; measurements up to ½ in. in submultiples of 0.005 in. can be made. Working distance between objective and object is 5½ in. The instrument has rack and pinion focusing with a variable tension control and lock. A knob controls 360° lateral movement of the microscope; it is possible to reverse the microscope bracket and to move the objective below table level. (Edmund Scientific Corp., Dept. Sc., Barrington, N.J.)

Laboratory workers can use a new **ringstand microadjustor** designed by Fred E. D'Amour of the University of Denver to avoid the difficulty encountered in raising or lowering the clamp holding a piece of apparatus when it is clamped directly to the ringstand. The apparatus is clamped to the sleeve of the adjustor (Fig. 1) in approximately the desired position; it may then be raised or lowered very precisely by means of the knurled thumbscrew. The sleeve is tongued to a slot in the vertical bar so that it cannot rotate. $8. (Phipps and Bird, Inc., Dept. Sc., Richmond, Va.)

Fig. 1.

A new semiexpendable **tissue receptacle** is available to users of the Autotechnicon. The bottom of the receptacle is molded of Bakelite. The lid, a paperboard disk that also supports the tissue during its processing run, snaps into a groove on the rim of the bottom. Multiple holes in both lid and bottom allow free circulation of processing fluids during immersion and rapid drainage after removal. Identification can be penciled on top of the lid. Cardboard dividers and auxiliary biopsy liners are also available. (Technicon Co., Dept. Sc., 215 E. 149 St., New York 51.)

Miscellaneous

Mineral Resources of Fort Defiance and Tohatchi Quadrangles, Arizona and New Mexico by John Eliot Allen and Robert Balk may be obtained for $2.50 from the State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology, Campus Station, Socorro, N. Mex. Designed for the U.S. Bureau of Indian Affairs as a thorough survey of all mineral and water resources that might furnish a basis for new income for the Navajos, this 216-page report presents geologic descriptions of 484 mi² of the Navajo reservation. Included are the Defiance anticline, the Buell Park caldera, and the south end of the Chuska Mountains. Descriptions of 30 rock units ranging in age from Precambrian to Recent, shown on a colored geologic map that is printed on a photomosaic base, are included, as well as a special section on sedimentary petrology by Max Willard. Although commercial deposits of uranium and oil have not yet been discovered in the area, the formations in which they occur elsewhere are carefully described and delineated with numerous detailed measured sections.

The **American Board of Nutrition** will hold its next certifying examinations during Apr. 1955 at locations convenient for candidates. Completed applications of persons who wish to be considered for certification should be submitted *not later than 1 Feb. 1955.* Application forms may be obtained from the secretary, Otto A. Bessey, Department of Biochemistry and Nutrition, The University of Texas School of Medicine, Galveston.

The October issue of The American Film Forum's regular monthly release is entitled ***Do Security Regulations Hamper Science?*** This film features Congressman Thomas Burke of Missouri and John S. Toll, chairman of the physics department of the University of Maryland, discussing this subject. The moderator for all Forum films is Marquis Childs, columnist and commentator. These reels are available from the American Film Forum, Inc., 516 Fifth Ave., New York 36.

Publication of a new series of molybdenum chemical data bulletins has been announced by the **Climax Molybdenum Co.** These bulletins are designed to provide, in a concise form, authoritative data on the properties of molybdenum compounds. Previously such data were often difficult to find in the literature and hard to evaluate. Copies of this data series are available from the Climax Molybdenum Co., 500 Fifth Ave., New York 36.

Book Reviews

***Snow Crystals*: *Natural and Artificial*.** Ukichiro Nakaya. Harvard Univ. Press, Cambridge, 1954. xii + 510 pp. Illus. $10.

This book is an account of more than 20 years of physical investigations on snow that were conducted at Hokkaido University in Sapporo, Japan, on nearby Mount Asari, and on a slope of Mount Takachi, near the center of Hokkaido Island. The author presents a general classification of snow crystals, recognizing seven distinct phyla. These vary from needles and columns, through fernlike crystals developed in one plane, to combinations of column and plane crystals, columnar crystals with extended side planes, rimed crystals (those with cloud particles attached), and a miscellaneous category of irregular crystals. He describes how this relatively simple approach to the study of snow crystals compelled him to seek knowledge of their physical properties, which in turn forced him into their artificial production in order to understand how they grow in nature.

As if working at extremely cold temperatures and struggling under adverse conditions of war were not enough, fortune tossed a bomb at the publisher's printing office during the last days of World War II and destroyed all the copper plates and the original type. The fact that the work was finally published, first in Japanese, and then in English, and lavishly illustrated with snow crystal photographs that are models of artistry as well as of excellent science, is due to the generous assistance of many individuals and organizations in the United States and in Japan. Nakaya credits a great many people, but he pays special tribute to the help and encouragement given by Charles F. Brooks of Harvard University and by H. C. Kelly and B. C. Dees, now with the National Science Foundation. His own university and the American Academy of Arts and Sciences were among the institutions that provided financial support.

In addition to the solution of many photomicrographic problems, his early work involved measurements of the mass and velocity of the fall of individual crystals in order to find the relationship between these quantities and crystal size and form. Finally, studies were made of the electric nature of snow particles and the frequency of occurrence for each type of crystal form. Of particular significance was the discovery that plane crystals of hexagonal symmetry and fernlike appearance, although best known, are not the most typical or the most common. They constitute only a small part of the naturally formed types. The author and his band of assistants found the irregular types far more abundant.

This book sheds new light on the long-standing mystery that has surrounded the conditions controlling the formation of symmetrical forms. The mass of single crystals, their thickness, rate of fall, and electric charges are measured, tabulated, and discussed. A cold chamber developed in the laboratory for producing artificial crystals shows considerable ingenuity. Mixing a cold air current with a warm wet air current is not at all difficult. But suspending crystals in the air for long periods of time, in order to consider the question of crystal development apart from that of nucleus formation, is something else again. This was solved in the Hokkaido University Cold Temperature Laboratory by suspending filaments of rabbit hair or silk in the crystal-growing chamber. It was found that all types of crystals could be grown on these filaments by varying the physical conditions.

Nakaya does not, however, delve very deeply into questions of nucleation, the formation of early crystal stages from microscopic and submicroscopic nuclei. For knowledge in this field he recommends the work of Irving Langmuir and Vincent J. Schaefer that was accomplished under "Project Cirrus." Their work "solved the question of formation of an ice cloud by seeding, and our experiments are confined to the problem of development of the snow-crystal proper from the ice-cloud particle," Nakaya explains.

Laymen may find some sections of this source book rather tough sledding, highly technical, and extremely detailed. But for scientists working in meteorology and allied fields, these very sections will provide a gold mine of needed data. No one can open the volume without some gain, however, for much of the text is simple and easily understood. Featured in the illustrations are more than 1500 beautiful crystals, a source of much inspiration for readers with artistic or designing abilities.

HERBERT B. NICHOLS

General Electric Research Laboratory, Schenectady, New York

***Chemistry of the Defect Solid State*.** A. L. G. Rees. Methuen, London; Wiley, New York, 1954. viii + 136 pp. Illus. $2.

Into the space of 136 small pages, which include 42 diagrams, six tables, and a bibliography, the author has compressed a large amount of information on the nature of lattice defects and on their effects on physicochemical processes. The material is very well organized into seven chapters dealing with the nature of crystalline defects, elements of the theory of the defect solid state, outline of experimental methods for the study of defects, chemical consequences of defect structures, tarnishing and decomposition reactions, heterogeneous catalysis, and outstanding problems. A bibliography of 66 references is appended.

Much of the material can be followed by readers who are almost unacquainted with the field. For example, the qualitative description of the quantum theory of the defect solid state is very lucidly presented. Other topics are treated too sketchily because of severe space

limitations. For instance, the statistical treatment is so condensed that it is difficult to follow the reasoning that connects initial postulates with final equations. However, the author attempts to make the results plausible by comparing them with the quasi-chemical approximation, and this is helpful in such brief discussions.

The space allotted to different topics is often puzzling. For example, 8½ printed pages, including four diagrams and one table, are devoted to a rapid-fire survey that covers the use of adsorption and emission of radiation, excitation energies, photoconductivity, luminescence, thermoluminescence, Hall effect, and thermoelectric power measurements for the determination of electronic energy states. By contrast, 1½ pages are devoted to the description of the Hahn emanation method.

Attention should be directed to a number of original contributions by the author. These include suggestions for further research that might clarify outstanding problems, a statistical treatment of solids exhibiting gross departures from stoichiometric composition, and the incorporation of "solution processes" into the mechanism of catalytic reactions. In addition, the author proposes an adequate symbolism and nomenclature for the various types of defects encountered experimentally. The adoption of this or a similar set of conventions should be seriously considered in order to standardize the widely different conventions prevalent in the literature.

The book seems to be relatively free from typographical and other errors. The symbol κ on page 48 is not defined. Unfortunately, the 1952 and 1953 papers pertaining to the use of the semiconductor model in the interpretation of chemisorption phenomena are not mentioned.

Perhaps this book serves its purpose best as a fairly inclusive summary of ideas pertinent to our present understanding of the defect structure in solids, and thus certainly fulfills one of its principal aims.

J.M. HONIG
Department of Chemistry, Purdue University

***Thomas Young, Natural Philosopher*: 1773–1829.** The late Alexander Wood; completed by Frank Oldham. Cambridge Univ. Press, New York, 1954. xx + 355 pp. Illus. + plates. $6.

This work by the late university lecturer in experimental physics at the University of Cambridge is the first full-scale biography of Thomas Young since the classic memoir by Dean Peacock, which appeared in 1855. It is a wholly appropriate memorial for the 125th anniversary of the death of one of the most celebrated natural philosophers who ever wrote in the English language. When we reflect that medicine was his profession and that much of his work in physics was strictly avocational, it is indeed somewhat surprising to note how often and in what varied context his name still occurs in the standard textbooks of today: Young's modulus in elasticity, Young's law of nodes in the vibrating string, Young's interference experiment (wave theory of light), and the Young-Helmholtz theory of color vision. And when we further recall that the same man was a sufficiently competent classical scholar and philologist to provide a considerable part of the key to the Rosetta Stone and to write authoritatively on the origin of languages, we cannot help feeling that this versatile genius should be better known in the 20th century.

Although Wood's book is by no means a distinguished literary venture, it should go far toward restoring Young's true position as one of the founders of modern field physics. The familiar story of the establishment of the wave theory of light is retold here, and indeed rather more perspicuously in terms of modern notation than in the pages of Peacock. It becomes strikingly evident, as the author proceeds, that Young very early grasped the real nature of physical theory—the bold and effective use of hypothesis. To be sure, he was bitterly assailed for this by his critics, notably Brougham, who, although a very brilliant man, possessed an inadequate conception of the nature of physical science. This is not surprising, since physical methodology, or the attempt to assess what physicists really do in describing the world, did not become fashionable until the late 19th century. As a matter of fact, Wood makes it clear that much of the bitterness of Brougham's criticism was very likely the result of a personal animus against Young, who had himself referred in print, with unnecessary severity, to an early mathematical paper by Brougham. The resentment of the Edinburgh reviewer was natural, although one may regret the influence it had in delaying serious consideration of Young's wave theory for many years. It seems clear that Young's scientific personality was not all "sweetness and light." His writings betray a very definite egotistical strain coupled with a blunt impatience with the "errors" of others. He must have impressed many of his contemporaries as being somewhat arrogant.

Not the least interesting feature of Young's life is the paradox it affords of a man who chose medicine as his profession but could not resist the temptation to dabble in fundamental science. Except for the two courses of lectures on natural philosophy that he gave at the Royal Institution in 1802 and 1803, this latter concern must be considered primarily avocational. Yet it was precisely here that he made his principal contribution to thought. It is generally agreed that, although he continued to practice medicine until 1822, he was never very successful as a physician. On the other hand, his lectures on physics were a failure as lectures for the audience to which he addressed them, and yet the book that resulted from these lectures has been referred to by Sir Joseph Larmor as the "greatest and most original of all lecture courses" and by the author of this biography as "a more complete account of the subject than has appeared in English either before or since."

Young's claim to fame as a philologist in connection with his deciphering of a part of the Rosetta Stone

has long been somewhat clouded by the celebrated controversy over the relative merits of his contribution and that of the French savant, Champollion. The whole problem is examined once again in dispassionate fashion by Wood, and Young emerges with his stature in this field rather heightened by the evidence presented. Actually it appears that there was ample credit to go around!

It is not generally recognized that Young contributed notably to the success of the early editions of the *Encyclopedia Britannica* by his authoritative articles on such varied subjects as "Cohesion," "Egypt," "Bridge," "Chromatics," "Weights and measures," "Tides," "Lagrange," and "Road making." By a singular irony, the biography of Young himself that appeared in the 11th edition of the *Britannica* (1911) was omitted in the 14th edition (1929). Fortunately it has been restored in the latest reprinting.

Unfortunately Alexander Wood did not live to complete his writing of Young's biography. Frank Oldham, whose interest in Young is attested by his own brief life of the natural philosopher (1933), has done a commendable job of finishing the work. A brief memoir on Wood, whose books on sound are recognized as of great value by all acousticians, prefaces the volume, which will undoubtedly be greatly cherished by all who are interested in the history of physics.

R. B. LINDSAY
Department of Physics, Brown University

Energy Transfer in Hot Gases. Proceedings of NBS Symposium held 17–18 Sept., 1951 National Bureau of Standards, (Supt. of Documents), Washington, D. C., 1954. iv + 126 pp. Illus. $1.50.

This book contains 10 papers of a spectroscopic nature, two on reaction mechanisms, two on the flame mechanics, and two on flame temperatures.

Only a few interesting details, taken at random from these reports, can be mentioned here to give an idea of the scope of the symposium. One such detail, reported by Benedict and Plyler, is the discrepancy between temperatures measured in hydrocarbon flames, that is, 2400° to 2800°K obtained from resolved infrared spectra, and values of more than 3000°K obtained from the visible and ultraviolet spectra for the same flame regions. It is attributed to the difference in lifetime in transitions (10^{-3} to 10^{-1} sec and 10^{-8} to 10^{-6} sec, respectively). This means that molecules that radiate vibration-rotation energy will have survived many collisions and, hence, will have a much greater chance of being near to thermodynamic equilibrium than molecules that emit electronic energy.

According to Sen's article on "Astrophysicist's concept of temperature," deviations from thermodynamic equilibrium also play a decisive role in solar and stellar thermometry and have led to the use of "operational concepts of temperature," such as "effective temperature," "color temperature," "excitation temperature," and "ionization temperature." Only in the relatively seldom occurring case of complete equilibrium are all these temperatures *one and the same,* and one can speak of *the* temperature of the stellar atmosphere. The author mentions that this is not a purely academic question:

> The solar chromosphere and corona, and the highly turbulent atmospheres of giant stars are Nature's gigantic laboratories for the testing of new physical theories of turbulence, shock waves, and departures from thermadynamic equilibrium.

For the time being, Penner, in his study on infrared emissivity of diatomic gases, has developed an equation which he claims is the only available relationship for estimating the equilibrium emissivities of diatomic gases under the conditions existing in rocket combustion chambers, our low-scale imitations of stellar fast-moving furnaces.

Persons not too familiar with the details of spectroscopy will find particular interest in Bernard Lewis' comprehensive paper on the theory of combustion waves in which suitably simplified models of the combustion wave are envisaged and explained, some considering only diffusion, others only the flow of heat, and so forth. Another paper, contributed by Karlovitz, describes in some detail how turbulent flames can generate additional turbulence.

Finally, it may be mentioned that a "Combustion colloquium" was held at Cambridge University, England, 2 years after the National Bureau of Standard's symposium. It comprised 18 contributions, mostly on flame propagation, only two on spectroscopy, which have been edited by W. R. Hawthorne and J. Fabri under the title *Selected Combustion Problems: Fundamental and Aeronautical Applications* (Cambridge Univ. Press, 1953, viii + 534 pp.).

MAX JAKOB
Department of Mechanical Engineering, Illinois Institute of Technology

Essays on the Social History of Science. S. Lilley, Ed. Munksgaard, Copenhagen, 1953. 182 pp. Paper, Kr. 30.

This book has been produced under the auspices of the Commission for the History of the Social Relations of Science, a group that was appointed by the International Union for the History of Science, which is the administrative organ of the International Academy for the History of Science. Financial assistance was provided by UNESCO, and this organization suggested the original idea for the preparation of this book.

We must be grateful to UNESCO, as well as to the editor and the authors, for producing a work of significance for all who are concerned with the social relationships of science, and this means almost everyone—scientist and nonscientist alike.

The essays cover a wide range in time and in subject matter. Several of the titles will indicate the rich content of this thought-provoking volume: "The rise of abstract science among the Greeks" by B. Farring-

ton; "Thoughts on the social relations of science and technology in China" by J. Needham; "Metallurgy and technology in the Middle Ages" by R. J. Forbes; "Cause and effect in the history of science" by S. Lilley; "The French Revolution and the progress of science" by R. Taton; "The idea of progress and theories of evolution in science" by S. F. Mason; "Science, industry and society in the nineteenth century" by J. D. Bernal; "Science and confidence in the rational mind" by Dorothy Waley Singer.

This is a noteworthy collection of essays and it will repay careful reading. Not all readers will agree with all the points of view advanced, but it is this very heterodoxy that makes this book important.

MORRIS C. LEIKIND
Armed Forces Institute of Pathology

Elements of Statistical Mechanics. D. ter Haar. Rhinehart, New York, 1954. xix + 468 pp. Illus. $8.50.

The author's preface says

> The reason for writing another textbook on statistical mechanics was the feeling that there should be a textbook which combined in not too large a volume an outline of the main elements . . . with an account of a number of successful applications . . . the book is meant to be a textbook . . . for graduate lectures in the United States or for postgraduate lectures in the United Kingdom.

Part A, 97 pages, discusses the elements of the statistics of independent particles (perfect gases), with little mention of applications; part B, 73 pages, gives ensemble theory; part C, 159 pages, discusses applications in eight chapters, equation of state, condensation, metals, semiconductors, cooperative phenomena (order-disorder), nuclear physics, the origin of elements, and rubber elasticity; part D, 145 pages, is labeled "Appendices." It gives a more detailed discussion of some of the topics considered in parts A and B and a few fundamental topics not explicitly discussed in the text. Most chapters are followed by a page or more of bibliography.

The chemist will be struck by the omission of any mention of the very real success of statistical mechanical theory in computing, from spectroscopic data, the thermodynamic properties of many substances in the gaseous state, and also by the omission of any discussion of applications to liquids, ionic solutions, or magnetic or electric susceptibility measurements. Since just these subjects constitute the main interest of physical chemists in statistical mechanics, the book will be of more interest to physicists than to chemists. With this limitation the book adequately covers its intended purpose. Rather than attempting a single unified approach, the author, in different chapters, tends to discuss most of the important approaches used by different investigators. Insofar as a single approach carries the thread, it is that of Kramers, to whom the author makes due acknowledgment. Of necessity, since so much is mentioned, parts of the discussion are scanty and end with "we refer the reader to the original publication for a more detailed discussion." The extensive bibliography will be valuable to the serious student.

The book seems to suffer from some defects. Classical and quantum statistics are rigidly separated in different chapters. Since statistical mechanics offers the easiest field for unifying and merging quantum and classical behavior, this seems highly unfortunate. The author does not appear to have written all parts for students of the same level of sophistication. For instance, in chapter III quantum mechanics is introduced to a reader who had not yet heard of h, but in chapter VII the density matrix operator is used with the assumption that the student is fully familiar with operator theory. Occasionally rather simple but important principles are either omitted or quite inadequately stressed. For instance, that Bose rather than Fermo statistics apply to atoms or molecules containing an even number of neutrons appears not to be stated, and the reader of chapters IV or VIII, in which the behavior of helium is discussed at length, might have the impression that it is still very uncertain which statistics to use for He_4, and no reason for choice in the case of He_3.

JOSEPH E. MAYER
Institute for Nuclear Studies, University of Chicago

Histology. Roy O. Greep, Ed. Blakiston, New York, 1954. xi + 953 pp. Illus. + color plates. $15.

This textbook is the result of the combined efforts of 13 contributors who are able teachers and investigators. Each of the authors is presently or has been associated with Harvard University. Under the editorship of Roy O. Greep, an excellent textbook has resulted. The subject is well covered and presented, although the inevitable change in style from one author to the next detracts somewhat from continuity.

The embryologic approach to an understanding of histology is not as complete as appeared in the Bremer-Weatherford *Textbook of Histology* (which this text was originally meant to revise), yet the presentation of this subject is sufficient where necessary, without overdoing it. The inclusion of a chapter describing some basic histochemical methods is very apropos the type of histologic investigation now holding the interest of workers in the field.

The book is well illustrated; the color plates are of exceptional quality. The labeled photomicrographs of the testes, endometrium, and kidney, to cite a few examples, are of the type that are most helpful to and most appreciated by the student of histology. In this connection, more photographs of this type, rather than line drawings of tissues and cells, would add much to this book's usefulness in the laboratory. Its high cost will probably be an important consideration in its adoption.

EARL B. SCOTT
Department of Anatomy, School of Medicine, University of South Dakota

New Books

Business Management. Efficiency surveys and systems. John A. Shubin. Barnes and Noble, New York, 1954. x + 372 pp. Illus. Paper, $1.75.

General Chemistry. W. Norton Jones, Jr. Blakiston, New York, 1954. xii + 907 pp. Illus. $6.50.

Recent Progress in Hormone Research. vol. X. Proc. of the Laurentian Hormone Conference. Gregory Pincus, Ed. Academic Press, New York, 1954. 511 pp. Illus. $9.80.

Sir William Petty. Portrait of a genius. E. Strauss. Free Press, Glencoe, Ill., 1954. 260 pp. $5.

The Sun, the Sea, and Tomorrow. Potential sources of food, energy and minerals from the sea. F. G. Walton Smith and Henry Chapin. Scribner, New York, 1954. xii + 210 pp. Illus. $3.50.

Micro and Semimicro Methods. Nicholas D. Cheronis. vol. VI of *Technique of Organic Chemistry*; Arnold Weissberger, Ed. Interscience, New York–London, 1954. xxiii + 628 pp. Illus. $12.

Meredith's Hygiene. A textbook for college students on physical, mental, and social health from personal and public aspects. Arthur F. Davis and Warren H. Southworth. Blakiston, New York–Toronto, ed. 5, 1954. xv + 906 pp. Illus. $6.

Introduction to Modern Algebra and Matrix Theory. Ross A. Beaumont and Richard W. Ball. Rinehart, New York, 1954. xii + 331 pp. $6.

Directory of International Scientific Organizations. UNESCO, Paris, ed. 2, 1954 (Distr. by Columbia Univ. Press, New York). 312 pp. Paper, $2.50.

Directory of Hydrobiological Laboratories and Personnel in North America. Robert W. Hiatt, Ed. Univ. of Hawaii Press, Honolulu, 1954. ix + 324 pp. Illus. $3.75.

Grundlagen und Praxis chemischer Tumorbehandlung. Zweites Freiburger Symposion an der Medizinischen Universitäts-Klinik. J. Pirwitz. Springer, Berlin, 1954. 289 pp. Illus. Paper, DM. 45.

An Outline of Developmental Physiology. C. P. Raven. Trans. by L. de Ruiter. McGraw-Hill, New York and Pergamon Press, London, Engl. ed. 1, 1954. viii + 216 pp. Illus. + plates. $5.50.

An Introduction to Human Biochemical Genetics. H. Harris. Eugenics Laboratory Memoirs, XXXVII. Cambridge Univ. Press, New York, 1953. 96 pp. Illus. $2.75.

Flash. Seeing the unseen by ultra high-speed photography. Harold E. Edgerton and James R. Killian, Jr. Branford, Boston, ed. 2, 1954. 215 pp. Illus. $6.50.

Galen of Pergamon. George Sarton. Univ. of Kansas Press, Lawrence, 1954. 112 pp. Illus. $2.50.

Animal Form and Function. An introduction to college zoology. W. R. Breneman. Ginn, Boston, 1954. viii + 488 pp. Illus. $6.

Animal Cytology and Evolution. M. J. D. White. Cambridge Univ. Press, New York, ed. 2, 1954. xiv + 454 pp. Illus. $8.50.

My Life with the Microbes. Selman A. Waksman. Simon & Schuster, New York, 1954. xii + 364 pp. $5.

America's Resources of Specialized Talent. A current appraisal and a look ahead. Report of the Commission on Human Resources and Advanced Training; Dael Wolfle, director. Harper, New York, 1954. xviii + 332 pp. Illus. $4.

Effects of Electricity on Muscular Motion. Luigi Galvani. Trans. by Margaret Glover Foley. Burndy Library, Norwalk, Conn., 1954. 176 pp. Illus. + plates. $6.

Human Heredity. James V. Neel and William J. Schull. Univ. of Chicago Press, 1954. vii + 361 pp. Illus. $6.

Wasserbestimmung mit Karl-Fischer-Lösung. Ernst Eberius. Verlag Chemie, Weinheim/Bergstr., Germany, 1954. 138 pp. Illus. Paper, DM. 12.80.

Science Milestones. The story of the epic scientific achievements and the men who made them possible. George B. Clementson, Ed. Windsor Press, Chicago, 1954. 312 pp. Illus. $5.

The Psychology of Invention in the Mathematical Field. Jacques Hadamard. Dover, New York, 1954. Reprint of ed. 1 (1945). xiii + 145 pp. Paper, $1.25; cloth, $2.50.

Principles of Internal Medicine. T. R. Harrison, Raymond D. Adams, William H. Resnik, Paul B. Beeson, George W. Thorn, and M. M. Wintrobe, Eds. Blakiston, New York–Toronto, ed. 2, 1954. xxiii + 1703 pp. Illus. + plates. Student, 1-vol. ed., $16.; professional, 2-vol. ed. boxed, $21.

Physiology. Rolland J. Main. Rev. by Alfred W. Richardson. Mosby, St. Louis, ed. 2, 1953. 474 pp. Illus. $7.

Pajarito Plateau and Its Ancient People. Edgar L. Hewett. Rev. by Bertha P. Dutton. Univ. of New Mexico Press, Albuquerque, ed. 2, 1953. x + 174 pp. Illus. + plates. $4.50.

Miscellaneous Publications

Radioactive-Waste Disposal in the Ocean. Handbook 58. Natl. Bur. of Standards, Washington 25, 1954 (Order from Supt. of Documents, Washington 25.) 31 pp. 20¢.

Retroreflectors for Use on Road Signs and Vehicles. Natl. Standards Lab. Tech. Paper No. 5 R. G. Giovanelli. Commonwealth Scientific and Industrial Research Organization, Melbourne, 1954. 16 pp. Illus.

Economic Progress in the French Union, 1946–1953. Service de Presse et d'Information de l'Ambassade de France, New York 21, 1954. 70 pp. Illus.

On the Formation of the Acrosome and Mitochondria' Nebenkern in Prodenia litura ***Fabr. and*** Anaphaeis ***sp. Studies on Insect Spermatogenesis, No. 2, Lepidoptera.*** Res. Bull., Zoology, No. 45. Sukhdev Raj Bawa. Panjab Univ., Hoshiarpur, India, 1954. 10 pp. + plates. R. 2-4-0.

Spectra of the Late N-Type Stars in the Ultra-Violet, Violet and Blue-Green Regions. No. 33. P. Swings, A. McKellar, and K. Narahari Rao. Dominion Astrophysical Observatory, Victoria, B.C., 1953. 12 pp. + plates.

Intelligence: Statistical Conceptions of its Nature. DPP 5. L. J. Bischof. 33 pp. Illus. 85¢. ***Religion and Society.*** SSS 5. Elizabeth K. Nottingham. 84 pp. 95¢. Doubleday, Garden City, N.Y., 1954.

Report of the Twenty-Ninth Meeting. Sydney: August 1952. vol. 29. J. F. Kefford, Ed. Australian and New Zealand Assoc. for the Advancement of Science, Sydney, 1953. 386 pp. Illus.

California Fishing Ports. Fish Bull. No. 96. W. L. Scofield. Dept. of Fish and Game, Sacramento 14, Calif. 1954. 159 pp. Illus.

Distribution of Radio Brightness on the Solar Disk. Spec. Rpt. No. 4. ***Interstellar Hydrogen.*** Spec. Rpt. No. 5. Internatl. Scientific Radio Union, Brussels, 1954. 71 pp. Illus. $2.

Interferometer Microscope. Catalog CM 2595. Cooke Troughton & Simms, York, England, 1954 (Order from R. Y. Ferner Co., Malden 48, Mass.). 12 pp. Illus.

Technical Papers

Susceptibility to Experimental Atherosclerosis and the Methylation of Ethanolamine-1,2-C^{14} to Phosphatidyl Choline*

Laurence O. Pilgeram† and David M. Greenberg

Department of Physiological Chemistry, School of Medicine, University of California, Berkeley

There are indications in the literature that there may be a relationship between the susceptibility of certain species to atherosclerosis and their phospholipid metabolism. It has been demonstrated that the incidence and severity of cholesterol-induced atherosclerosis in rabbits is decreased if the blood phospholipid is elevated concomitantly with the cholesterol (*1*). In the human being, the ratio of total cholesterol to phospholipids was appreciably increased in coronary disease as compared with normal control groups (*2*). The poorer clearing of the alimentary lipemia observed in atherosclerotic males as compared with the clearance rate in normal males (*3*) may also bear a relationship to the metabolism of the phospholipids in that the enzymic removal of lecithin from serums by the α-toxin of *Cl. welchii* will produce or increase lipemia (*4*). This enzymic degradation has been shown to be specific for lecithin, with a slow degradation also occurring for sphingomyelin (*5, 6*). Cephalin and phosphatidyl serine are unaffected.

Collectively these reports suggest that part of the metabolic block in the metabolism of the lipids that occurs in the atherosclerotic is a lack of formation of lecithin (phosphatidyl choline) or an increased abnormal degradation thereof. The possibility exists that it may be necessary for the ethanolamine base to be methylated and to form lecithin before clearing action becomes evident.

In order to gain further information on the possible relationship of the biosynthesis of lecithin to atherosclerosis, the formation of lecithin from free ethanolamine was investigated in liver slices of rats, which to date have been demonstrated to be immune to experimental gross atherosclerosis (*4, 8, 9, 10*) and in liver slices of guinea pigs and chicks, species that are susceptible (*10, 11*).

Table 1 demonstrates a striking difference between the ability of the rat to form lecithin from free ethanolamine and the ability of the chick or the guinea pig to accomplish this process. The chick and the guinea pig possess a total liver capacity equal to 3.8 and 3.1 percent, respectively, of the capacity of the rat. Comparing the ratios of lecithin formation of the livers to body weight, the chick possesses a capacity equal to 2.2 percent and the guinea pig 1.2 percent of the capacity of the rat. These differences are also supported by the data for the conversion per unit weight of liver tissue.

The results obtained with ethanolamine-1,2-C^{14} could be construed as indicating that, instead of a greater capacity for synthesis, the rat liver possessed a larger pool of active methionine for the methylation of ethanolamine than did the chick or the guinea pig, or that the rat liver diluted the labeled ethanolamine less than did the liver tissue of the other two species, with the consequence that a greater yield of labeled lecithin was produced. That this is not correct is proved by the much higher radioactivity of the phosphatidylcholine of rat liver obtained when $C^{14}H_3$-methionine was used as the methyl donor for unlabeled ethanolamine.

Present knowledge points to a correlation between the state of the chemical metabolism of cholesterol and the susceptibility to atherosclerosis. Data on total cholesterol/phospholipid ratios and their change with atherosclerosis (*1, 2*) suggest that at least part of the metabolism of cholesterol is related to the phospholipids. The mechanism has not been clarified. Examination of the published observations of changes in the total cholesterol/phospholipid ratios that are correlated with atherosclerosis reveals that in all cases total phospholipid phosphorus or total phospholipids were measured. It would appear, therefore, that at least part of the present confusion on whether the phospholipids deter atherogenesis (*10*) could be due to the analytic and interpretative treatment of the phospholipids as a homogeneous group of substances in relation to the cholesterol/phospholipid ratio.

Table 1. Comparison of phosphatidyl choline formation from ethanolamine by the rat, guinea pig, and chick. The relative ability of nonfasted Long-Evans strain rats, English Shorthair guinea pigs, and White Leghorn chicks to convert ethanolamine-1,2-C^{14} to phosphatidyl choline: Liver slices, totaling 500 mg, were incubated aerobically for 2 hr at 37°C in 5 ml of Krebs-Ringer phosphate solution containing 0.0016*M* $CaCl_2$ at a *p*H of 7.4. The isolation of phosphatidyl choline was carried out as reported previously (*12*) with the exception that the acetone-precipitation step was eliminated and that choline was counted as the Reinecke salt derivative.

Animal species	No.	Total counts in phosphatidyl choline per 100 sec		
		Per 500 mg of liver tissue	Per total liver mass	Total liver count/wt. (g) of animal
Rat	10*	1,180	16,520	94.5
	2†	32,000		
Guinea pig	4*	9	515	1.1
Chick	4*	40	640	2.1
	2†	768		

Substrates: * Ethanolamine-1,2-C^{14} (3.8×10^{-4}*M* and 239,000 counts/100 sec); Methionine (7.5×10^{-4}*M*). † $C^{14}H_3$-Methionine (3.0×10^{-4}*M* and 311,000 counts/100 sec); Ethanolamine (3.8×10^{-4}*M*).

The data in Table 1, obtained by methods developed (*12*) to distinguish between such constituents as phosphatidyl ethanolamine, serine, choline, and sphingomyelin may provide a clue leading to the nature of the metabolic block that gives rise to prolonged alimentary lipemia in the atherosclerotic and to atherosclerosis. A fraction of this metabolic block may be the relative lack of ability of certain animal species to form lecithin. This conclusion is reinforced by the observations of Ahrens and Kunkel on the necessity of lecithin for clearing action (*4*) and by the correlation of the results reported in this paper with the species difference in the susceptibility to experimental atherosclerosis induced by cholesterol and other means. The data suggest that *certain* phospholipids are necessary for normal cholesterol breakdown or metabolism.

References and Notes

* Aided by research grants from the Life Insurance Medical Research Fund.

† Postdoctoral fellow of the Life Insurance Medical Research Fund. Present address: Department of Physiology, University of Illinois College of Medicine, Chicago.

1. A. T. Ladd, A. Kellner, and J. W. Correll, *Federation Proc.* **8**, 360 (1949).
2. M. M. Gertler, S. M. Garn, and J. Lerman, *Circulation* **2**, 205 (1950).
3. W. J. Block, N. W. Barker, and F. D. Mann, *Circulation* **4**, 674 (1951).
4. E. H. Ahrens, Jr., and H. G. Kunkel, *J. Exptl. Med.* **90**, 409 (1949).
5. M. G. MacFarlane, *Biochem. J. (London)* **42**, 587 (1948).
6. P. C. Zamecnik, L. E. Brewster, and F. Lipmann, *J. Exptl. Med.* **85**, 381 (1947).
7. W. C. Hueper, *Arch. Pathol.* **38**, 162, 245, 350 (1944); *ibid.* **39**, 51, 117, 187 (1945).
8. L. Horlick and L. Havel, *J. Lab. Clin. Med.* **33**, 1029 (1948).
9. W. Marx *et al.*, *Arch. Pathol.* **47**, 440 (1949).
10. L. N. Katz and J. Stamler, *Experimental Atherosclerosis* (Thomas, Springfield, Ill., 1953).
11. R. Altschul, *Selected Studies on Arteriosclerosis* (Thomas, Springfield, Ill., 1950); *Am. Heart J.* **40**, 401 (1950).
12. L. O. Pilgeram *et al.*, *J. Biol. Chem.* **204**, 367 (1953).

15 June 1954.

Similarities in Histochemical Differentiation of Insect Cuticle and the Walls of Parasitic Fungi

A. Glenn Richards

Department of Entomology and Economic Zoology, University of Minnesota, St. Paul

Incidental to a study of the pathology induced by the parasitic fungus *Herpomyces stylopygae* Spegazzini growing on the cuticle of oriental cockroaches (*Blatta orientalis* Linné) it was noticed that Mallory's triple stain gave a similar staining picture for the fungal walls and the insect cuticle. In both, the developing membrane first stains blue; later, parts of it change and stain red; still later, some parts become brown or black and refractory to staining. In insects this well-known sequence of changes occurs in areas called sclerites and the process is known as sclerotization (*7*). In this fungus all the walls remain undifferentiated (that is, stain blue) except the peculiar basal "shield" growing from the secondary receptacle. This shield undergoes changes paralleling those of cuticle undergoing sclerotization, as is shown in Fig. 1.

The genus *Herpomyces* belongs to the Laboulbeniales of the Ascomycetеae. Like ascomycetes in general,

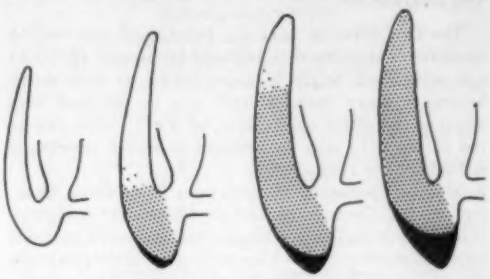


Fig. 1. Diagrammatic representation of color changes shown with Mallory's triple stain during differentiation of the basal "shield" of *H. stylopygae*. Sketched as seen in longitudinal section with "shield" on left and connection to secondary receptacle and rhizoid on right; cell protoplasts ignored. *Unshaded outline*, blue staining walls; *stippled areas*, red staining walls; *black areas*, amber to black walls refractory to staining.

its walls contain chitin instead of cellulose. Von Wettstein (*2*) failed to obtain a positive test for chitin in a species of *Laboulbenia* and tentatively stated that chitin was absent from this group. Ulrich (*3*) accepted this report as fact despite von Wettstein's clear reservation on such a conclusion because he had inadequate material for testing. The chitosan test for chitin (*1*) is positive with *Herpomyces*, although one has to be relatively gentle in applying the test or the walls will disintegrate and be lost (the same is true for the wing scales of certain moths). The walls are also positive for protein (Millon and ninhydrin tests).

Serial sections of the fungus show that the wall is composed of a relatively thick chitin-protein layer giving the afore-mentioned reactions and an extremely thin ($< 1\ \mu$ thick) surface layer which stains red or purplish with Mallory's stain.

These similarities suggested that some of the other color tests currently used in studies on insect cuticle be performed. The data may be summarized by saying that insect cuticle and *Herpomyces* cell walls are similar in these respects:

1) They have a thin surface layer staining red with Mallory's stain.

2) They have a thicker underlying layer containing chitin and protein.

3) They have the thicker layer showing the illustrated staining sequence during development of certain areas.

4) They have the brown or black color removed by treatment with hot NaOH or KOH solutions and by Diaphanol.

5) They are positive to the argentaffin test (ammoniacal $AgNO_3$), which in insect cuticle has been shown to be indicative of orthodihydroxyphenols involved in the sclerotization process.

6) They give the argentaffin reaction primarily in the

portions that will later stain red with Mallory's stain or be refractory to that stain (in *Herpomyces* primarily in the thin surface layer and in the "shield").

7) At certain stages they are positive for the $FeCl_3$-Na_2CO_3 test, which is a more specific reaction for orthodihydroxyphenols.

The two differ in that (i) the fungal cell wall is negative to staining with buffered osmic acid (*p*H 7.4) and with Black Sudan B, hence giving no evidence of having a waxy coating, and (ii) in the fact that whereas the green color given by $FeCl_3$, changing to red in Na_2CO_3, may be brilliant in insect cuticles, it is faint in the fungal walls.

Another species of *Herpomyces, H. ectobiae* Thaxter on the German cockroach (*Blattella germanica* Linné), is completely white in life. In serial sections its walls show only the blue color with Mallory's stain except for the thin reddish surface layer. This species, then, shows no parallel to the sclerotization process in insects. However, numerous insects have soft, unsclerotized cuticles during larval stages. The many other species of Laboulbeniales all grow as parasites on the cuticle of various living insects. Many of them have a dark or black "foot" appressed to the insect's cuticle. In view of the foregoing data it seems reasonable to suggest that the common blackening of portions of the wall of Laboulbeniales species may be based on reactions similar to those occurring in the host's cuticle. To be sure, tyrosinase activity is already well known in fungi and other plants; but whether the natural dark colors are due to condensation of indole-type structures, as with mushroom tyrosinase *in vitro* (*4*), or to the linkage of structural protein or protein-chitin chains by deaminated derivatives, as in insect cuticle (*1*), is not clear.

One might ask whether precursors for these processes are derived from the insect or synthesized by the fungus. Perhaps one might interpret the presence of numerous argentophile granules in the rhizoids penetrating the insect's cuticle as indicating that precursors may be obtained from the host, but the host has finished sclerotization before the fungus develops and at this stage shows little reaction to the argentaffin reagent. Such questions cannot be settled until someone learns how to cultivate these fungi, which are currently listed as obligatory parasites.

It seems to me that a closer comparison of data on chemical events in insect cuticles and fungal walls might well be valuable to both entomology and mycology. For instance, the work of Castle (*5*) on sporangiophore development illustrates a problem more favorably studied with fungal walls, whereas the relative ease with which large amounts of cuticle can be separated from protoplasm makes arthropod material more favorable for certain chemical studies.

References and Notes

* Paper No. 3164, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul 1. The work reported was performed in connection with a contract between the Office of the Surgeon General, U.S. Army and the University of Minnesota.

1. A. G. Richards, *The Integument of Arthropods* (Univ. of Minnesota Press, Minneapolis, 1951).
2. F. von Wettstein, *Sitzber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. I*, **130**, 3 (1921).
3. R. Ulrich, *Rev. mycol. (Paris), Mém. hors.-sér.*, No. 3 (1943), pp. 1–44.
4. H. S. Mason, *J. Biol. Chem.* **172**, 83 (1948).
5. E. S. Castle, *Quart Rev. Biol.* **28**, 364 (1953).

14 June 1954.

Histamine Liberation *in vitro* and Mode of Binding of Histamine in Tissues

Allan L. Grossberg and Humberto Garcia-Arocha

Department of Physiology,
McGill University, Montreal, Canada

In a recent paper on the intracellular distribution of histamine in dog's liver, Hagen (*1*) reported that a suspension in isotonic sucrose of the large granule fraction, which contains much of the bound histamine of the whole liver homogenate (*2*), releases its histamine when diluted with distilled water. During the course of an investigation of the mechanism of histamine liberation, we have employed a similar preparation and had independently made the same observation. We wish to report this confirmation of Hagen's work, together with additional observations that bear on the problem of histamine liberation.

The preparation employed is based on the original observation of Trethewie (*3*) that dog liver cellular fragments still retain bound histamine. Dog liver, perfused blood-free, is ground with sand in isotonic (0.32*M*) sucrose. The particulate fraction is brought down to 5000 *g* for 30 min in the cold, washed twice, and resuspended in the sucrose solution. The total histamine present in this fraction varies from 3 to 10 μg/g wet weight of the original tissue, and nonsedimentable histamine amounts to 5 to 10 percent of the total. Addition of 2 to 4 vol of distilled water immediately and quantitatively converts all the histamine to the nonsedimentable form, even at 0°C. In addition, the histamine is totally released by treating the suspension with 90 percent acetone in the cold, both in the presence and absence of a sufficient concentration of soybean trypsin inhibitor to eliminate the possibility that a trypsinlike enzymatic action is involved. Freezing and thawing the suspension quantitatively releases the bound histamine—an observation also reported by Hagen. Finally, addition of known lytic substances such as saponin, sodium taurocholate, and lysolecithin, at final concentrations of 5 to 200 μg/ml, rapidly and completely liberates histamine from the particles. It is noteworthy that the latter two of these substances have been reported to liberate histamine *in vivo* (*4, 5*). Hagen (*1*) observed that the surface-active compound octylamine (1 mg/ml) released histamine in his preparation.

The afore-mentioned actions take place at the *p*H (6.5) of the unbuffered sucrose suspension and at *p*H's up to 8.5, above which the suspension becomes increasingly less stable with respect to binding of

histamine. Upon addition of known basic histamine liberators such as 1,10-diaminodecane (DA10) and propamidine (*6*), or compound 48/80 (*7*), at final concentrations of 10 to 200 μg/ml, or of rat serum anaphylatoxin prepared according to Novy and DeKruif (*8*), histamine is progressively released from the particles. This liberation is temperature-, *p*H-, and concentration-dependent. The rate of release by 10 μg/ml 48/80 is usually sufficient to set free all the histamine within 60 min at *p*H 8 and 37°C. There is a much smaller, but measurable, rate of release in the controls. Doubling the liberator concentration approximately doubles the rate of release. The rate is 2 to 3 times less at *p*H 7, in the case of 48/80, and is even more markedly reduced at the lower *p*H in the case of DA10. The Q_{10} is approximately 2. These factors probably explain the failure by Hagen (*1*) and Copenhaver, Nagler, and Goth (*2*) to observe histamine release at room temperature by 48/80 and stilbamidine, respectively, in their unbuffered preparations.

All the foregoing observations have been repeated on a similar liver particle suspension (*9*) prepared by replacing the sucrose solution with Tyrode buffer, in which the histamine is less stably bound. In addition, a sucrose suspension of particles from sheep-liver capsule behaves in a similar fashion to the sucrose homogenate of whole dog's liver. Riley and West (*10*) have shown that in this capsular tissue mast cells are the predominant cellular elements.

The evidence cited here strongly suggests that histamine is not bound to a tissue component by a primary chemical bond but is most likely enclosed in a diffusible form within a mitochondrionlike particle. If this is so, the final step, in any series of reactions leading to the release of histamine, would be a change in the properties of the particle-cytoplasm interface, permitting the histamine to diffuse out. This change can be thought of most simply as a rupture or increase in the permeability of a membrane enclosing the particle. Our conclusion is thus in accordance with that independently reached by Hagen: histamine can be released by procedures that might be expected to damage a surface membrane.

It should be noted that, in the case of histamine release by the simple basic histamine liberators, all the components necessary for this action are present, after addition of the liberator, in the washed granular material obtained from the histamine-rich tissue. In the tissues examined by us, and in many other tissues, histamine appears to be located mainly in the mast cells (*10*), and it is attractive to suppose that the characteristic granules of these cells contain histamine and have a membrane that can be lysed by physical and chemical agents. The idea that such intracellular bodies are enclosed by a membrane that serves as a diffusion barrier is supported by permeability (*11*) and electronmicrographic (*12*) studies of liver mitochondria. In intact tissue, as Riley (*13*) has shown, the mast cells themselves are disrupted by the action of a basic chemical histamine liberator or of anaphylatoxin, presumably by an extension to the cellular membrane of the lytic action responsible for distintegration of the intracellular granules.

A complete report of this and related investigations will be published elsewhere (*14*).

References and Notes

1. P. Hagen, *Brit. J. Pharmacol.* **9**, 100 (1954).
2. J. H. Copenhaver, Jr., M. E. Nagler, and A. Goth, *J. Pharmacol. Exptl. Therap.* **109**, 401 (1953).
3. E. R. Trethewie, *Australian J. Exptl. Biol. Med. Sci.* **16**, 224 (1938).
4. M. Schachter, *Brit. J. Pharmacol.* **7**, 646 (1952).
5. W. Feldberg and C. H. Kellaway, *J. Physiol. (London)* **94**, 187 (1938).
6. F. C. MacIntosh and W. D. Paton, *ibid.* **109**, 190 (1949).
7. W. D. M. Paton, *Brit. J. Pharmacol.* **6**, 499 (1951).
8. F. C. Novy and P. H. DeKruif, *J. Infectious Diseases* **20**, 589 (1917).
9. H. Garcia-Arocha, J. G. Ashwin, and A. L. Grossberg, *Abstr. XIX Intern. Physiol. Cong.* (1953), p. 378.
10. J. F. Riley and G. B. West, *J. Physiol.* **120**, 528 (1953).
11. W. G. Spector, *Proc. Roy. Soc. (London)* **B141**, 268 (1953).
12. A. J. Dalton *et al. J. Natl. Cancer Inst.* **9**, 439 (1948–49).
13. J. F. Riley, *J. Pathol. Bacteriol.* **65**, 471 (1953).

14. This work was supported by a grant from the Division of Medical Research of the National Research Council of Canada.

18 June 1954.

In vivo Activity of Pantothenylcyst(e)ine for Rats and Chicks

R. Q. Thompson and O. D. Bird

Research Laboratories,
Parke, Davis and Company, Detroit, Michigan

Pantothenylcystine has been reported by Brown and Snell (*1*) to exhibit less than 2 percent of the activity of pantothenate for *L. arabinosus*, *L. casei*, and *S. carlsbergensis*. King and Cheldelin (*2*) and Brown and Snell (*3*) in studies comparing the activity of pantothenic acid conjugates for *A. suboxydans* found that pantetheine and pantothenylcysteine were more active than pantothenic acid or pantoic acid but somewhat less active than 4′-phosphopantetheine or coenzyme A. From these studies it was concluded that those derivatives containing a —SH group are, in general, considerably more active than the corresponding disulfide forms.

In view of the published data concerning the requirement for cystine in the biosynthesis of coenzyme A (*4*) and the microbiological activity of pantothenylcyst(e)ine, it seemed of interest to determine whether this latter compound would show biological activity in pantothenic acid-depleted animals. Recently Hoagland and Novelli (*5*) have shown that pantothenylcystine can be converted to pantetheine by treatment with a rat-liver supernatant. These findings are of interest in view of the data presented here, which show that pantothenylcyst(e)ine has little if any significant pantothenic acid activity in rats or chicks.

One-day-old White Leghorn S.C. chicks of mixed sex were prepared for the pantothenic acid assay as described by Thompson, Bird, and Peterson (*6*). In the two chick experiments reported, the birds were

given a practical diet for 3 days, followed by a pantothenic acid-deficient diet for 12 and 7 days, respectively. Following this depletion period, 10 chicks were assigned to each experimental group, taking into consideration equal distribution of body weight.

In experiment 3, weanling albino rats averaging 40 g received a pantothenic acid-deficient diet of the following percentage composition: hot alcohol-extracted casein 24.5, cerelose 60.3, corn oil 10.0, Jones and Foster (*7*) salt mix 4.0, vitamin mix 0.5, and choline chloride 0.15. The vitamin mix, which was diluted with casein, supplied the following vitamins in milligrams per kilogram of finished diet: thiamine 8, riboflavin 8, pyridoxine 8, niacin 100 *p*-aminobenzoic acid 10, menadione 5, biotin 0.1, and vitamin B_{12} 0.03. The diet also contained 120 mg α-tocopheryl-acetate, 90,000 USP units vitamin A, and 9000 USP units vitamin D each per kilogram. At the end of a 27-day depletion period, the rats were uniformly distributed according to body weight among the respective groups. The negative control group contained 11 animals; the other two groups contained 10 animals each.

Table 1. Growth promoting activity of pantothenylcyst(e)ine.

Treatment	Pantothenic acid equivalent (mg)	Weight gain* 7 days (g)	Weight gain* 14 days (g)
Experiment 1 (chicks)			
None		9 (10)	4 (7)
Calcium pantothenate			
0.25 mg/100 g diet	0.23	17 (10)	29 (6)
0.50 mg/100 g diet	.46	36 (9)	64 (6)
0.75 mg/100 g diet	.69	41 (10)	81 (9)
1.0 mg/100 g diet	.91	34 (10)	74 (10)
Pantothenylcystine			
0.8 mg/100 g diet	.55	5 (10)	9 (4)
75 μg/day injected IM†	.051	11 (10)	20 (5)
75 μg/day injected IP	.051	10 (10)	17 (9)
Experiment 2 (chicks)			
None		4 (10)	11 (10)
Calcium pantothenate			
43.2 μg/day injected IP	0.04	27 (10)	54 (8)
87.4 μg/day injected IP	.08	49 (10)	98 (10)
Pantotheylcysteine			
Mercury mercaptide			
77 μg/day injected IP	.04	9 (10)	17 (9)
154 μg/day injected IP	.08	7 (10)	19 (9)
308 μg/day injected IP	.16	11 (9)	22 (7)
Experiment 3 (rats)			
None		4 (11)	9 (9)
Calcium pantothenate			
50 μg/day injected IP	0.046	28 (9)	61 (8)
Pantothenylcystine			
67.5 μg/day injected IP	.046	8 (10)	20 (9)

* Figures in parentheses indicate survival.
† IM means intramuscularly; IP means intraperitoneally.

Supplements of calcium pantothenate, pantothenylcystine, or the mercuric mercaptide of pantothenylcysteine were either incorporated in the pantothenic acid-deficient diet or injected intramuscularly or intraperitoneally as aqueous solutions (*8*). Those supplements given by injection were administered three times weekly. Supplementation in both the rat and chick experiments was continued for 2 wk. Growth data obtained from these experiments are presented in Table 1.

In experiment 1, rather severe mortality occurred, which probably resulted from an excessive depletion period. Although there was a marked response to calcium pantothenate, no response occurred with a supplement of pantothenylcystine that should have been sufficient to supply the chick with about half the amount of pantothenic acid required for maximum growth. Moreover, pantothenylcystine did not produce any significant response when injected either intramuscularly or intraperitoneally.

Since the reduced forms of pantethine derivatives show more activity than the corresponding disulfides in the tests employing microorganisms, it seemed worth while to test the mercury mercaptide of pantothenylcysteine in chicks. However, previous work (*6*) had shown that the mercuric mercaptide of pantetheine was no more active than pantethine in chicks. As is indicated in experiment 2, the mercury mercaptide of pantothenylcysteine was also inactive in promoting growth in pantothenic acid-depleted chicks.

Similarly, in experiment 3, pantothenylcystine exhibited little if any significant activity in pantothenic acid-depleted rats.

Under the conditions of the experiments reported, pantothenylcyst(e)ine does not promote the growth of pantothenic acid-depleted chicks or rats. Furthermore, the rat or chick apparently is not capable of cleaving this compound and utilizing the pantothenic acid moiety. In view of the data of Hoagland and Novelli (*5*) concerning the *in vitro* activity of pantothenylcystine, further investigation is indicated in order to clarify the discrepancy between the *in vivo* and *in vitro* activity of pantothenylcysteine.

References and Notes

1. G. M. Brown and E. E. Snell, *J. Am. Chem. Soc.* **75**, 2782 (1953).
2. T. E. King and V. H. Cheldelin, *Proc. Soc. Exptl. Biol. Med.* **84**, 591 (1953).
3. G. M. Brown and E. E. Snell, *J. Bacteriol.* **67**, 465 (1954).
4. W. S. Pierpoint and D. E. Hughes, *Biochem. J. (London)* **56**, 130 (1954).
5. M. B. Hoagland and G. D. Novelli, *J. Biol. Chem.* **207**, 767 (1954).
6. R. Q. Thompson, O. D. Bird, and F. E. Peterson, *J. Nutrition*, in press.
7. J. H. Jones and C. J. Foster, *Ibid.* **24**, 245 (1942).
8. Pantothenylcystine and mercuric mercaptide of pantothenylcysteine were kindly supplied by J. F. Cavalla and R. E. Bowman of Parke, Davis and Co., Ltd., Hounslow, England, and by E. E. Snell, University of Texas, respectively.

14 June 1954.

Association Affairs

Special Events at the Berkeley Meeting

AAAS Special Sessions

One of the characteristic and most important features of the annual meeting of the Association is the series of outstanding general addresses by distinguished persons, sponsored by organizations that meet regularly with the AAAS. These special events are joint sessions with the Association and are open to the general public of the city in which the meeting is held.

1) Monday, 27 Dec., 8:30 P.M., 155 Dwinelle; *United Chapters of Phi Beta Kappa*: "Our splintered learning and the status of scientists" by Conway Zirkle, professor of botany, University of Pennsylvania, Philadelphia. Peter H. Odegard, chairman, Department of Political Science, University of California, Berkeley, and member of the Senate of the United Chapters of Phi Beta Kappa, will preside.

2) Monday, 27 Dec., 8:30 P.M., Berkeley High School Auditorium; *National Geographic Society*: "Five-star Burma" (illustrated) by W. Robert Moore, chief, foreign editorial staff, National Geographic Society. Wallace W. Atwood, Jr., director, Office of International Relations, National Academy of Sciences–National Research Council, Washington, D.C., and vice president for AAAS Section E, will preside.

3) Tuesday, 28 Dec., 8 P.M., Wheeler Auditorium; *AAAS Presidential Address*: "A half-century of quantum physics" by Edward U. Condon, director of research, Corning Glass Works, and retiring president of the Association. Warren Weaver, director, Division of Natural Sciences and Agriculture, Rockefeller Foundation, and president of the Association, will preside. Preceding the address, Robert Gordon Sproul, president, University of California, and general chairman of the Berkeley meeting, will speak briefly. Following the address there will be an informal AAAS Presidential Reception in the nearby Stephens Union Clubrooms. All registrants and members of the local committees are cordially invited to attend.

4) Wednesday, 29 Dec., 8 P.M., Wheeler Auditorium; *Society of the Sigma Xi*: "High-energy physics" by Edwin M. McMillan, professor of physics, University of California. Joseph W. Barker, director, Research Corporation, and acting president, the Society of the Sigma Xi, will preside.

5) Thursday, 30 Dec., 4 P.M., Wheeler Auditorium; *Pacific Science Board*: "The human background of Pacific science" by Alexander Spoehr, director, Bernice P. Bishop Museum, Honolulu. Knowles A. Ryerson, dean, College of Agriculture, University of California, Berkeley, and past chairman, Pacific Science Board, will preside.

6) Thursday, 30 Dec., 8 P.M., Wheeler Auditorium; *Scientific Research Society of America*: "Science and progress?" by Vannevar Bush, president, Carnegie Institution of Washington. Joseph W. Barker, director, Research Corporation, and chairman, the Scientific Research Society of America, will preside.

AAAS Conferences

In recent years, in addition to the Academy Conference, several conferences have become recurrent events at AAAS meetings. Also, not infrequently, interest in special subjects may develop to the point where a special program is arranged. These conferences and special programs are open to all who are interested.

1) *Academy Conference*. Two sessions: Monday morning and afternoon, 27 Dec., 33 Dwinelle.

2) *Conference on Scientific Editorial Problems*. Four sessions: Wednesday morning, afternoon, and evening, and Thursday afternoon, 29 and 30 Dec., 125 Hilgard.

3) *Conference on Scientific Manpower*. Two sessions: Tuesday and Wednesday mornings, 28 and 29 Dec., 104 Engineering.

4) *International Conference on Animal Venoms*, sponsored by AAAS Sections F and N. Eight sessions: 4 days, 27–30 Dec., 155 Dwinelle.

5) *Third Berkeley Symposium on Mathematical Statistics and Probability*, arranged by the Statistical Laboratory of the University of California. Ten sessions: 5 days, 27–31 Dec.

AAAS Special Program

The Association, its Cooperative Committee on the Teaching of Science and Mathematics, the Academy Conference, the Engineering Manpower Commission, and the Scientific Manpower Commission are cosponsoring an all-day session, planned as a forum to discuss and to launch an action program to attempt to meet the acute problem of the shortage of qualified science teachers. The morning session will be directed to research scientists; the afternoon, to those interested in the recruiting and training of teachers.

The crisis in science education, part I, Thursday, 30 Dec., 10 A.M., auditorium, Chemistry Building. John R. Mayor, chairman of the Cooperative Committee and chairman of the Department of Education, University of Wisconsin, will preside. (i) "The scientist's responsibility to the science teacher" by George W. Beadle, president elect of the AAAS and head of the Department of Biology, California Institute of Technology; (ii) "The educator's responsibility to the science teacher" by Samuel Brownell, U.S. Commissioner of Education.

The crisis in science education, part II, Thursday, 30 Dec., 2 P.M., auditorium, Chemistry Building. Dael Wolfle, administrative secretary, AAAS, will preside. (i) "The AAAS program to improve science teaching" by Dael Wolfle; (ii) "The program from the point of view of the high school" by Wayne Taylor, Denton (Texas) High School; (iii) "The program from the point of view of the college of education" by William A. Brownell, dean, College of Education, University of California, Berkeley; (iv) "The program from the point of view of the graduate school" by Vern O. Knudsen, dean, Graduate School, University of California, Los Angeles; (v) "The program from the point of view of the liberal arts college" by E. Wilson Lyon, president, Pomona College.

AAAS Symposiums

Well-established scientists and younger specialists alike anticipate the AAAS symposiums, which have become an increasingly important aspect of the annual meetings of the Association.

AAAS symposiums explore relatively neglected areas

of scientific inquiry or constitute up-to-date surveys of knowledge in particular fields. Such programs are significant and valuable because they focus attention on critical areas, summarize the present status of current research, and provide positions from which to direct further research. These programs originate in the minds of the officers and committeemen of the 18 sections of the Association and are developed by them, either personally or by others deputized as program chairmen. Often, the sectional symposiums are concerned with interdisciplinary problems and are sponsored by two or more sections; participating societies also may collaborate. If the demand warrants it, the papers of such programs are gathered together and published by the Association as symposium volumes.

In recent years there has become well established the practice of arranging, for each annual meeting, one or two symposiums of especially wide interest or timeliness. The responsibility for developing these general symposiums, sponsored by the Association as a whole, rests upon the AAAS Symposium Committee, appointed each year by the president of the Association. Upon occasion, a proposed sectional program may be chosen to be developed as a general symposium; more commonly, the Symposium Committee, which represents a variety of scientific fields, plans and arranges these general sessions itself. The committee may seek the aid of consultants and appoint others to implement the general symposiums.

The Symposium Committee met in February and decided upon one three-session general symposium that would give broad consideration to some of the principal problems confronting society today and their interrelations with science.

AAAS General Symposium

Science and society, part I, "Natural resources: power, metals, food." Monday, 27 Dec., 4 P.M., Wheeler Auditorium. Arranged by Louis B. Slichter, director, Institute of Geophysics, University of California, Los Angeles. Donald H. McLaughlin, president, Homestake Mining Company, San Francisco, will preside. (i) "Fuels and energy for the future" by Farrington Daniels, chairman, Department of Chemistry, University of Wisconsin; (ii) "Minerals for the future" by Evan Just, vice president, Cyprus Mines Corporation, New York; (iii) "Food for the future" by J. G. Harrar, deputy director for agriculture, Division of Natural Sciences and Agriculture, The Rockefeller Foundation, New York.

Science and society, part II, "Population problems." Tuesday, 28 Dec., 4 P.M., Wheeler Auditorium. Arranged by Curt Stern, professor of zoology, University of California, Berkeley. Curt Stern will preside. (i) "Introduction" by Curt Stern; (ii) "Dynamics of human populations" by Dudley Kirk, Population Council, Inc., New York; (iii) "Medical aspects" by Alan Gregg, vice president, Rockefeller Foundation, Big Sur, California; (iv) "Concluding remarks" by Curt Stern.

Science and Society, part III, "Science in human thought and action." Wednesday, 29 Dec., 4 P.M., Wheeler Auditorium. Arranged by Roger R. Revelle, director, Scripps Institution of Oceanography, La Jolla, California. Roger R. Revelle will preside. (i) "The role of the sciences in education" by Joel H. Hildebrand, emeritus professor of chemistry and chemical engineering, University of California, Berkeley; (ii) "Science and international cooperation" by Bart J. Bok, professor of astronomy, Harvard University, Cambridge, Massachusetts; (iii) "Logics and the human nervous system" by John von Neumann, Institute for Advanced Study, Princeton, New Jersey, and the Atomic Energy Commission.

RAYMOND L. TAYLOR
Associate Administrative Secretary

New AAAS Sections

The number of AAAS sections has increased from 16 to 18 as a result of Council approval of the elevation of former Section N Subsections Nd-Dentistry and Np-Pharmacy to full sectional status. (Former Subsection Nm-Medicine will now be identical with Section N-Medical Sciences.)

For some years the Sections on Dentistry and Pharmacy have had their own secretaries and arranged separate full programs at the annual meetings of the Association. Henceforth, with their own vice presidents and section committees, they may enlarge their activities and function as sections in their own right.

Increasing sentiment among Nd and Np members favoring sectional status crystallized at the Boston meeting and petitions were directed to the Section N Committee which approved. Subsequently, the AAAS Board of Directors endorsed this action and approval by the AAAS Council was granted by a mail ballot. The former secretaries of the subsections—Russell W. Bunting, dean, School of Dentistry, University of Michigan, and Glenn L. Jenkins, dean, School of Pharmacy, Purdue University—will continue as sectional secretaries, and complete sectional organization will be concluded at the Berkeley meeting.

The following affiliated and associated societies have been transferred to the new sections:

Nd—Dentistry

Affiliated Societies: American College of Dentists; American Dental Association; International Association for Dental Research, American Division. *Associated Society*: American Association of Dental Schools.

Np—Pharmacy

Affiliated Societies: American College of Apothecaries; American Pharmaceutical Association. *Associated Societies*: American Association of Colleges of Pharmacy; American Society of Hospital Pharmacists.

AMINO ACID METABOLISM

Edited by William D. McElroy and Bentley Glass

The synthesis and degradation of amino acids and their incorporation into proteins were discussed in a symposium sponsored by the McCollum-Pratt Institute in June, 1954. The main topics and discussions covered in this book are:

CHAPTER 1: General Reactions, Mode of Transport and Protein Incorporation of Amino Acids.
CHAPTER 2: Metabolism of Glutamic Acids, Proline, Ornithine, Citrulline and Arginine.
CHAPTER 3: Metabolism of Histidine, Leucine, Isoleucine, Valine and Lysine.
CHAPTER 4: Metabolism of Methionine, Cysteine and Threonine.
CHAPTER 5: Metabolism of Glycine and Serine.
CHAPTER 6: Metabolism of Aromatic Amino Acids.

READY IN NOVEMBER - $12.50

New and useful *books in* biochemistry

THE Johns Hopkins PRESS

BALTIMORE 18, MARYLAND

THE MECHANISM OF ENZYME ACTION

Edited by William D. McElroy and Bentley Glass

The McCollum-Pratt Symposium of June, 1953. This book, concerned with the fundamental problems related to the mechanism of enzyme action, emphasizes the importance of the catalytic protein as a reactant in biochemical transformations.

PUBLISHED - $11.00

FAT METABOLISM

A Symposium on the Clinical and Biochemical Aspects of Fat Utilization in Health and Disease

Edited by Victor A. Najjar

A collection of papers on fat metabolism, designed to bring to the clinical investigator the pertinent newer aspects of biochemistry and to the biochemist the clinical problems that have long furnished the stimulus to fundamental research.

OCTOBER - $4.50

SLEEPING ACCOMMODATIONS AT 121st AAAS MEETING

Berkeley, California, December 26-31, 1954

The hotel, motel, and dormitory sleeping accommodations—their rates and the application coupon below—are for your convenience in making room reservations in Berkeley. Please send your application *directly* to the AAAS Housing Bureau and thereby avoid delay and confusion. The experienced Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less. **Single rooms may become scarce; double rooms for single occupancy cost more; if possible, share a twin-bedded room with a colleague—and also save.** Mail your application *now* to secure your first choice of desired accommodations. All requests for reservations must give a definite date and estimated hour of arrival and also probable date of departure.

HOTELS	SINGLE	DOUBLE	TWIN	SUITE
Claremont	5.00–11.00	8.00–13.00	8.00–13.00	14.00–20.00
Durant	4.00– 7.00	6.00– 9.00	6.50–10.00	10.00–16.00
Shattuck	5.00–10.00	7.00–10.00	7.50–10.00	10.00–18.00
Other hotels	3.00– 5.00	3.50– 5.00	4.00– 6.50	7.00–10.00

(Note: Most hotels have singles without private bath at $2.00–$3.50 per night)

MOTELS				FAMILY ROOMS
Berkeley Plaza	5.00	6.00	7.00	8.50–12.00
California	4.00– 4.50	4.50– 5.00	5.50	6.00– 7.00
Golden Bear	4.50– 5.00	5.00– 7.00	6.00– 8.00	7.50–10.00
Other motels	4.00– 5.00	4.00– 6.00	5.50– 8.50	6.00–12.00

Dormitory Accommodations: NOTE: The 766 units in the University of California dormitories are **primarily for students, younger faculty members, and those not on expense accounts.** Occupancy, two persons per room; rate, $2.00 the first night, $1.00 per night thereafter, per person.

International House: Singles only, *without private bath*, $2.50 per night.

For a discussion of the headquarters of the participating societies and sections, please see Association Affairs, *Science*, July 23, or *The Scientific Monthly*, August.

THIS IS YOUR HOUSING RESERVATION COUPON

AAAS Housing Bureau
2223 Fulton Street
Berkeley 4, California

Date of Application .....

Please reserve the following accommodations for the 121st Meeting of the AAAS in Berkeley, Dec. 26–31, 1954:

First Choice ..... **Second Choice** ..... **Third Choice** .....
(State name of hotel, motel, or other)

..... Single Room — Desired Rate ..... — Maximum Rate .....
..... Double-bedded Room — Desired Rate ..... — Maximum Rate .....
..... Twin-bedded Room — Desired Rate ..... — Maximum Rate .....
..... Suite — Desired Rate ..... — Maximum Rate .....
..... Dormitory Unit(s)—two persons per room at $2.00 each first night, $1.00 per night thereafter.

HOTEL AND MOTEL ROOM DEPOSIT

$5.00 per reservation or $10.00 per room (*refunded if cancelled before Dec. 17*)

Make checks payable to "AAAS Housing Bureau."

The name and address of each person, including yourself, must be listed. Attach list if this space is insufficient.

.....

DATE OF ARRIVAL ..... DEPARTURE DATE .....
(These must be indicated—add approximate hour, a.m. or p.m.)

NAME .....
(Individual requesting reservation) (please print or type)

ADDRESS .....
(Street) (City and Zone) (State)

My society (or sectional interest) is: .....

I (will) (will not) have an automobile at the Meeting.

Mail this now to the Housing Bureau (address above). *Enclose hotel or motel room deposit. Make checks payable to AAAS HOUSING BUREAU.* **Rooms will be assigned and confirmed in order of receipt of reservation.**

A New International Centrifuge

FOR THE

Modern Laboratory

The new INTERNATIONAL MODEL U is more than just a Centrifuge in a cabinet. International's experienced engineering has produced a Centrifuge with years-ahead features and unmatched performance.

You will want to know more about the new aerodynamic guard bowl ventilating system—the new stainless steel interior — the stainless steel auxiliary cover that saves valuable bench space — the electric tachometer — the electric time clock — the unique air-filtering system—the spring-loaded hinge — the new vibration dampening system which results in smooth operation without the "shaker" action of over-flexible mountings — the versatility of 84 interchangeable accessory combinations.

Let us tell you more about this completely new Centrifuge, handsomely designed to fit in with your wall counters and cabinets. Write for Bulletin J explaining all these features in detail.

INTERNATIONAL EQUIPMENT COMPANY

1284 SOLDIERS FIELD ROAD, BOSTON 35, MASS.

GET YOUR ADVANCE COPY

of the General Program-Directory of the Berkeley Meeting of the AAAS

By first class mail – early in December

The General Program-Directory of the 121st Meeting of the AAAS on the campus of the University of California, Berkeley, Dec. 26–31, 1954, will be available to anyone, at cost, within the first week in December—whether he can attend the Meeting or not. You will want the General Program-Directory for your reference shelf.

Program content

1. The three-part General Symposium: "Science and Society."
2. Programs of the 18 AAAS sections (symposia and contributed papers).
3. Programs of the more than 70 participating societies.
4. The Special Sessions: AAAS, Academy Conference, Third Berkeley Symposium on Mathematical Statistics and Probability, Conference on Scientific Editorial Problems, National Geographic Society, Pacific Science Board, Phi Beta Kappa, Phi Kappa Phi, RESA, Sigma Xi.
5. Details of the Gymnasium for Men—center of the Meeting—and campus.
6. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
7. Exhibitors in the 1954 Annual Exposition of Science and Industry and descriptions of their exhibits.

Directory content

1. AAAS officers, staff, committees for 1954.
2. Complete roll of AAAS presidents and their fields.
3. The 260 affiliated organizations.
4. Historical sketch and organization of the Association; the Constitution and Bylaws.
5. Publications of the Association.
6. AAAS Awards and Grants—including all past winners.
7. Membership figures by sections.
8. Section committees (Council members) in detail.
9. Local committees.
10. Future Meetings of the AAAS—through 1958.

Advance Registration

Advance registration has these decided advantages: 1) You avoid delay at the Registration Center upon arrival; 2) You receive the General Program-Directory in ample time to decide, unhurriedly, which events and sessions you particularly wish to attend; 3) Your name is posted in the Visible Directory as the Meeting opens.

The following coupon may be used both by advance registrants and by those who wish only the advance copy of the General Program-Directory.

——— THIS IS YOUR COUPON FOR AN ADVANCE COPY OF THE GENERAL PROGRAM-DIRECTORY ———

1a. ☐ Enclosed is $2.50 for my advance Registration Fee which brings me the Program-Directory, Convention Badge, and all privileges of the Meeting.

1b. ☐ Enclosed is $1.50 for only the Program-Directory. (It is understood that, if I should attend the Meeting later, the Badge—which is necessary for all privileges of the Meeting—will be secured for $1.00 more.)
(Check one)

2. FULL NAME (Dr., Miss, etc.) .....
(Please print or typewrite) (Last) (First) (Initial)

3. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION .....

4. OFFICE OR HOME ADDRESS .....
(For receipt of Program-Directory)

5. YOUR FIELD OF INTEREST .....

6. CONVENTION ADDRESS .....
(May be added later, after arrival)

Please mail this Coupon and your check or money order for $2.50 or $1.50 to the
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
1515 Massachusetts Avenue, N.W., Washington 5, D. C.

Now Available

ANNUAL REVIEW OF MICROBIOLOGY

VOLUME 8 (1954)

". . . excellent summaries." (*J. Am. Med. Assoc.*, July, 1954)

"Quality of individual reviews is high." (*Quart. Rev. Biol.*, Vol. 28, No. 4, December, 1953)

Editor:
C. E. Clifton

Associate Editors:
S. Raffel
R. Stanier

Editorial Committee:
M. D. Eaton
J. M. Sherman
T. M. Sonneborn
E. C. Stakman
P. W. Wilson

Contents:

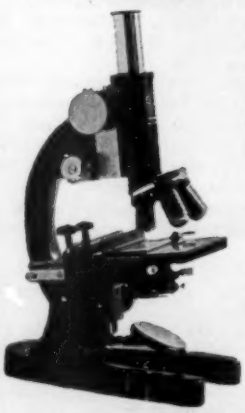
Cytology of Bacteria, *S. Mudd and E. D. DeLamater*
Nutrition of Microorganisms, *D. Hendlin*
Metabolism of Microorganisms, *J. J. R. Campbell*
Chemoautotrophic and Photosynthetic Bacteria, *C. B. van Niel*
Leptospira, *H. Schlossberger and H. Brandis*
Life History of Malaria Parasites, *P. C. C. Garnham*
Mechanisms of Antibacterial Action, *W. W. Umbreit*
Genetics of Microorganisms, *S. Spiegelman and O. E. Landman*
Bacterial Viruses, *E. A. Evans, Jr.*
Changes in Host Flora Induced by Chemotherapeutic Agents, *E. McCoy*
Physiological Aspects of Protozoan Infection, *B. G. Maegraith*
Hepatitis, Yellow Fever, and Dengue, *W. P. Havens, Jr.*
Antigenic Variation of Influenza Viruses, *M. Hilleman*
Labelled Antigens and Antibodies, *A. H. Coons*
Immunological Properties of Polysaccharides from Animal Parasites, *J. Oliver-González*
Nonspecific Factors in Immunity, *W. J. Nungester*
Effects of Viruses on Tumors, *A. E. Moore*
Bacterial Toxins, *C. L. Oakley*
Microbiology of Dairy Products, *J. J. Jezeski*
Foods and Feeds from Fungi, *F. S. Thatcher*
Cytopathology of Virus Infections, *J. F. Enders*

$7.00 postpaid **536 pages** **Cloth Bound** **Subject and Author Indexes**

Also Available: Vol. 2 (1948) to Vol. 7 (1953)

Published and On Sale By: **ANNUAL REVIEWS, INC.,** **Stanford, California**

NEW MEDICAL MICROSCOPE



MODEL GKM3

HIGHEST QUALITY despite the low price. Satisfaction guaranteed. Sold on ten days approval

Equipped with:
5x and 10x Oculars
Achromatic Objectives
16 mm (10x) n.a. 0.27
4mm (44x) n.a. 0.66
100x oil immersion abbe condenser with iris diaphragm
Plano-concave mirror and GRADUATED mechanical stage, with carrying case

$255.00

10% discount on 5 or more.

Write for catalogue

We accept old microscopes in trade—all makes.

EXPERT REPAIR WORK

THE GRAF-APSCO CO.
5868 Broadway **Chicago 40, Ill.**

Now available . . .

Adenosine Triphosphate (ATP); Amygdalin; Amylase; Animal Lecithin; Ascorbic Acid Oxidase; Bacitracin; BAL; Biotin, cryst.; Caffeic Acid; Carotene, cryst.; Catalase; Cellulase Chlorogenic Acid; Chorionic Gonadotropin; Circulatory Hormone; Colchicine; Cytidylic Acid; Cytochrome C; Dehydroascorbic Acid; Diacetonamine; Dihydroxyacetone; Dihydroxyphenylalanine (DOPA); Dipyridyl; Edestin; Emulsin; Erythritol; N-Ethylpiperidine; Fibroin; Folic Acid; Galacturonic Acid; Gentisic Acid; Girard Reagents P and T; Gliadin; Glucose Pentaacetate; Glucuronic Acid; Glyceraldehyde; Glyceric Acid; Heparin; Hordenine; Hyaluronidase; Hydrindene; 2-Hydroxyadipaldehyde; Humulon; Indan; Isoascorbic Acid; Isopropylarterenol; Kojic Acid; Kynurenic Acid; Lanthionine; Lipase; Lysozyme; Lyxose; Malononitrile; Maltase; Melezitose; Mesobilirubinogen; Muscle Adenylic Acid; p-Nitrophenylphosphate; Nucleoprotein; Orcinol; Pancreatin; Pantothenyl Alcohol; Penicillinase; Peroxidase; Phenazine; Phenylpyruvic Acid; Phloridzin; Phosphorylase; Piperin; Porphyrindine; Protamines; Protoporphyrin; Pyridoxal; Pyridoxamine; Pyrocatechuic Acid; Pyruvic Aldehyde; Ribonuclease; Saccharic Acid; Salmine; Serine Phosphoric Acid; Spermidine; Spermine; Thioacetic Acid; Thiocytosine; Thyroxine; Trigonelline; Triphenyltetrazolium Chloride; Tripyridyl; Trypsinogen; Tyrosinase; Tyrothricin; Urease; Uricase; Uridine; Vitellin; Xanthosine.

Ask us for others!

DELTA CHEMICAL WORKS, INC.
23 West 60th St. New York 23, N. Y.
Telephone Plaza 7-6317

Outstanding
McGRAW-HILL BOOKS

BOTANY:
Principles and Problems
New Fifth Edition

By EDMUND W. SINNOTT and KATHERINE W. WILSON, Yale University. Ready in January

The clear, simple, concise presentation; the treatment of the plant as a functioning structure; the applications of botanical theory to agricultural problems; and the wealth of stimulating questions have made this text a leader in its field for more than a quarter century. All material is thoroughly revised and brought up to date. The authors retain these successful features with a large number of splendid new illustrations and discussion of the latest advances in plant science.

CRYPTOGAMIC BOTANY
Second Edition
Volume I—Algae and Fungi
Volume II—Bryophytes and Pteridophytes

By GILBERT M. SMITH, Stanford University. *McGraw-Hill Publications in the Botanical Sciences.* Ready in January

This important two-volume reference covers the morphology of all plants below the level of seed plants. A chapter is devoted to each phylum of plants with a general discussion, followed by a detailed description of the structure and reproduction of a selected series of representatives. The introductory portion of each of the chapters has been rewritten. Descriptions of many of the representative genera have been revised in the light of new knowledge, and representatives with a wider geographical distribution have been substituted. The discussions of sexuality in fungi have been greatly expanded.

Send for copies on approval

McGRAW-HILL BOOK COMPANY, Inc.
330 West 42nd Street • New York 36, N. Y.

Meetings & Conferences

November

29–1. American Pomological Soc., annual, Springfield, Ill. (R. B. Tukey, Horticulture Dept., Purdue University, Lafayette, Ind.)

29–1. Assoc. of Military Surgeons, Washington, D.C. (R. R. Sayers, Armed Forces Inst. of Pathology, Washington 25.)

29–2. American Medical Assoc., clinical, Miami, Fla. (G. F. Lull, 535 Dearborn St., Chicago 10, Ill.)

30–2. Electronic Computer Clinic, 1st, New York, N.Y. (R. Rimbach, 845 Ridge Ave., Pittsburgh 12, Pa.)

December

1–2. Animal Care Panel, Chicago, Ill. (R. J. Flynn, Box 299, Lemont, Ill.)

1–3. American Rocket Soc., New York, N.Y. (ARS, 33 W. 39 St., New York 18.)

3–4. Oklahoma Acad. of Science, Tulsa, Okla. (R. E. Olson, Dept. of Geography, Univ. of Oklahoma, Norman.)

3–5. American Psychoanalytic Assoc., New York, N.Y. (R. L. Frank, 745 5 Ave., New York 22.)

4. American Alpine Club, Philadelphia, Pa. (J. C. Oberlin, 909 Leader Bldg., Cleveland 14, Ohio.)

5. American Acad. of Dental Medicine, 9th mid-annual, New York, N.Y. (W. M. Greenhut, 124 E. 84 St., New York 28.)

5–8. American Soc. of Agricultural Engineers, winter, Chicago, Ill. (F. B. Lanham, ASAE, St. Joseph, Mich.)

5–10. Radiological Soc. of North America, annual, New York, N.Y. (D. S. Childs, 713 E. Genesee St., Syracuse 2, N.Y.)

6–9. Entomological Soc. of America, Houston, Tex. (A. B. Gurney, 1530 P St., NW, Washington 5.)

8–9. Conf. on Myasthenia Gravis, Philadelphia, Pa. (Myasthenia Gravis Fdn., Inc., 2 E. 103 St., New York 29, N.Y.)

8–10. Eastern Joint Computer Conf., 4th annual, Philadelphia, Pa. (EJCC, P.O. Box 7825, Philadelphia 1.)

8–10. Western Forestry Conf., San Francisco, Calif. (C. S. Martin, 712 U.S. Natl. Bank Bldg., Portland 4, Ore.)

9–11. Texas Acad. of Science, annual, San Antonio, Tex. (G. H. Baird, P.O. Box 228, Huntsville.)

10–12. Florida Acad. of Science, Tallahassee, Fla. (R. A. Edwards, Dept. of Geology, Univ. of Florida, Gainesville.)

11–14. American Acad. of Optometry, annual, Toronto, Canada. (C. C. Koch, 1502 Foshay Tower, Minneapolis 2.)

11–22. World Forestry Cong., 4th, Dehra Dun, India. (T. Street, Foreign Agricultural Service, U.S. Department of Agriculture, Washington 25.)

13–15. American Inst. of Chemical Engineers, annual, New York, N.Y. (AIChE, 120 E. 41 St., New York 17.)

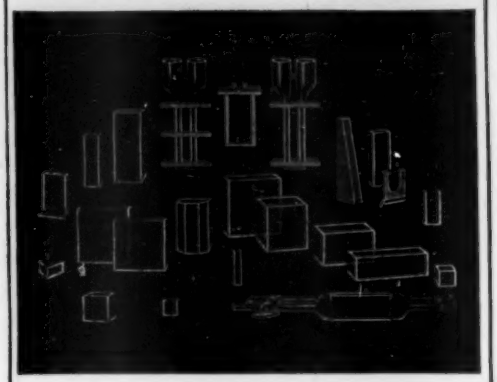
26–28. American Statistical Assoc., Berkeley, Calif. (S. Weiss, 1108 16 St., NW, Washington 6.)

26–29. National Science Teachers Assoc., Berkeley, Calif. (R. H. Carleton, 1201 16 St., NW, Washington 6.)

26–30. Inst. of Mathematical Statistics, Berkeley, Calif. (K. J. Arnold, Dept. of Mathematics, Michigan State College, E. Lansing.)

(See issue of 22 October for more comprehensive listings.)

GLASS ABSORPTION CELLS made by KLETT



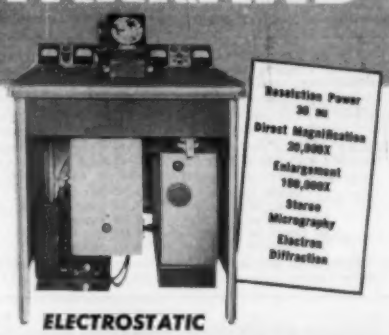
Makers of Complete Electrophoresus Apparatus

SCIENTIFIC APPARATUS

Klett-Summerson Photoelectric Colorimeters—Colorimeters — Nephelometers — Fluorimeters—Bio-Colorimeters — Comparators — Glass Standards—Klett Reagents.

Klett Manufacturing Co.
179 East 87 Street, New York, New York

FARRAND



ELECTROSTATIC

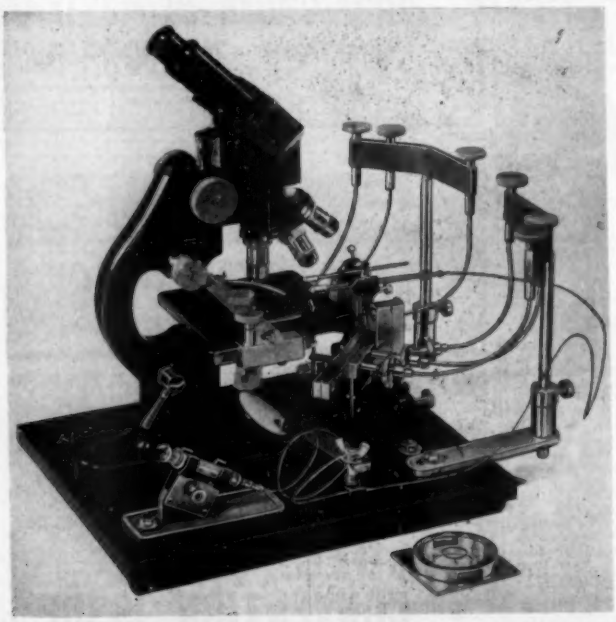
ELECTRON MICROSCOPE

The Farrand Electrostatic Electron Microscope is an instrument of high resolution with all of the advantages associated with electrostatic lenses. Design simplifies operation—Adaptable for stereo and diffraction micrography.

We invite you to visit our plant for a demonstration or write for Bulletin, No. 807.

- ENGINEERING
- RESEARCH
- DEVELOPMENT
- DESIGN and MANUFACTURE of PRECISION OPTICS ELECTRONICS and SCIENTIFIC INSTRUMENTS

FARRAND OPTICAL CO., Inc.
BRONX BLVD. & EAST 238th STREET
NEW YORK 70, NEW YORK



ONLY

The Chambers Micro Manipulator

offers you:

Two independently operated units mounted on common base with Microscope, and Micro Injection Apparatus.

Positive action without lag or drift. Direct or remote control operation,

COMPLETE at $610.00

Immediate Delivery!

BRINKMANN Instruments, Inc., ● **378–380 Gr. Neck Rd., Gr. Neck, L. I., N. Y.**

Other BRINKMANN Products: Exposure Meters for Photomicrography, Equipment for Paperelectrophoresis, Needle Pullers, Micro Cameras, Low Power Manipulators

PERSONNEL PLACEMENT

YOUR ad here reaches over 32,000 foremost scientists in the leading educational institutions, industrial laboratories, and research foundations in the U. S. and 76 foreign countries — at a very low cost

CLASSIFIED: 18¢ per word, minimum charge $3.60. Use of Box Number counts as 10 additional words.

DISPLAY: Rates listed below—no charge for Box Number. Monthly invoices will be sent on a charge account basis —provided that satisfactory credit is established.

Single insertion	**$19.50 per inch**
7 times in 1 year	**17.50 per inch**
13 times in 1 year	**16.00 per inch**
26 times in 1 year	**14.00 per inch**
52 times in 1 year	**12.50 per inch**

For PROOFS on display ads, copy must reach SCIENCE 4 weeks before date of issue (Friday of every week).

POSITIONS WANTED

Bacteriologist; M.S.; three years, research bacteriologist, state health department; six years, research bacteriologist in chemotherapy and antibiotics; three years, chief bacteriologist, pharmaceutical company. Medical Bureau (Burneice Larson, Director), Palmolive Building, Chicago. X

Pharmacologist: Extensive industrial experience and scientific background. Desires responsible position. Box 264, SCIENCE. X

Physicist, Ph.D. Fifteen years teaching experience. East preferred. Box 265, SCIENCE. X

Translator experienced in scientific field offers services translating Spanish and Russian scientific material. Box 263, SCIENCE. X

Yeast Geneticist, Ph.D., 3½ years post-doctoral research experience, publications, desires position in university, brewery or other fermentation industries. Married. Box 262, SCIENCE. 11/5

POSITIONS OPEN

Abstractor (female) to abstract medical journals—large ethical pharmaceutical company, Midwest. College graduate, Science Major, preferred. Reply Box No. 267, SCIENCE. 11/12, 19, 26

Bio-organic chemist, immediate opening, Department of Biochemistry, University of Oregon Medical School, Portland, Oregon, 3-year appointment. 11/12

(a) **Director**, clinical research; one of major pharmaceutical companies; $15,000. (b) **Biochemist**, M.S. or Ph.D., to take charge of biochemical department, 400-bed general hospital, preferably one interested in developing new techniques; large city, Midwest. (c) **Neuro-physiologist**, experienced with recording action potentials from nervous system, advantageous if trained in neuro-anatomy; research department of chemical company; $6500–$7000 if recently graduated Ph.D.; Midwest. (d) **Bacteriologist**; M.S. or Ph.D.; straight research; medical school department of medicine; Midwest. (e) **Psychologist** to serve as component of psychiatric clinic team; residential training school; newly created post, East. S11-1 Medical Bureau (Burneice Larson, Director), Palmolive Building, Chicago. X

M.D. with training and experience in sex endocrinology for position as director of an established department dealing with Research in Human Reproduction. The department is part of a medical research institute of a large mid-west hospital. Duties include supervision and interpretation of diagnostic tests. Box 266, SCIENCE. 11/12

Urgently required for work in Africa—one young geophysicist with Geochemical experience. Apply A. Brant, Box 366, Jerome, Arizona. X

POSITIONS OPEN

INVESTIGATOR

Familiar electronic approaches to biological problems, scanning and counting techniques, video and pulse circuits.

WRITE TO

Mr. George A. Kaye,
Employment Manager

ALLEN B. DU MONT LABORATORIES, INC.

35 Market Street

East Paterson, New Jersey

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

BOOKS AND MAGAZINES

Your sets and files of scientific journals are needed by our library and institutional customers. Please send us lists and description of periodical files you are willing to sell at high market prices. Write Dept. A3S, J. S. CANNER, INC. Boston 19, Massachusetts

DEC. 3.
CONVENTION ISSUE
Send your copy in, now!

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

CLASSIFIED: 25¢ per word, minimum charge $6.00. Use of Box Number counts as 10 additional words. Correct payment to SCIENCE must accompany ad.

DISPLAY: Rates listed below—no charge for Box Number. Monthly invoices will be sent on a charge account basis—provided that satisfactory credit is established.

Single insertion	$19.50 per inch
7 times in 1 year	17.50 per inch
13 times in 1 year	16.00 per inch
26 times in 1 year	14.00 per inch
52 times in 1 year	12.50 per inch

For PROOFS on display ads, copy must reach SCIENCE 4 weeks before date of issue (Friday of every week).

BOOKS AND MAGAZINES

WANTED TO PURCHASE . . .
SCIENTIFIC PERIODICALS and BOOKS
Sets and runs, foreign and domestic. Entire libraries and smaller collections wanted.
WALTER J. JOHNSON • 125 East 23rd St., New York 10, N. Y.

THE LOGIC OF MODERN SCIENCE
By J. R. KANTOR
375 pages $6.00
Principia Press, Inc., Bloomington, Indiana

PROFESSIONAL SERVICES

ANALYSIS OF AMINO ACIDS AND PROTEINS
VITAMINS, MINERALS, FOODS, SPECIAL DETERMINATIONS
SHANKMAN LABORATORIES
2023 SANTA FE AVENUE, LOS ANGELES 21, CALIFORNIA

SINCE 1870
Food Ingredient & New Drug Studies
TOXICOLOGICAL STUDIES
LaWall & Harrisson
Bacteriologists
Chemists : Pharmacologists
Div. S, 1921 Walnut St., Philadelphia 3, Pa.
ANALYSES • CONSULTATION • RESEARCH

SPECIFIC IMMUNE SERA
ANTI: Beef, Cat, Chicken, Deer, Dog, Horse, Human, Pork, Rabbit, Sheep (others on request).
$12.50 per 5 cc. Identifications performed. Write for details.
WISCONSIN ALUMNI RESEARCH FOUNDATION
506 N. Walnut Street Madison 5, Wisconsin

LOOKING FOR A PUBLISHER?
Write for Free Booklet SC telling how we can publish your book. All subjects considered. New authors welcome.
VANTAGE PRESS, Inc. • 120 W. 31 St., New York 1
In Calif.: 6356 Hollywood Blvd., Hollywood 28

PROFESSIONAL SERVICES

WISCONSIN ALUMNI RESEARCH FOUNDATION
LABORATORY SERVICES
Project research and consultation in Biochemistry, Chemistry, Bacteriology and Entomology
Mineral determinations including sodium and fluorine • Proximate analyses • Vitamin and amino acid assays • Food chemistry and microbiology • Enzyme investigations
Write for price schedule
WISCONSIN ALUMNI RESEARCH FOUNDATION
P. O. BOX 2059-V • MADISON 1, WISCONSIN

FOOD RESEARCH LABORATORIES, INC.
Founded 1922
Philip B. Hawk, Ph.D., President
Bernard L. Oser, Ph.D., Director
Research • Analyses • Consultation
Biological, Nutritional, Toxicological Studies for the Food, Drug and Allied Industries
48-14 33rd Street, Long Island City 1, N.Y.
• RESEARCH
• CONSULTATION
• ANALYSES

CONSULTATION RESEARCH
MICROBIOLOGY
PHARMACOLOGY
BIOCHEMISTRY
TOXICOLOGY
ANIMAL HISTOPATHOLOGY
SOUTH SHORE
ANALYTICAL AND RESEARCH LABORATORY, Inc.
148 ISLIP AVE. ISLIP, N. Y.

SUPPLIES AND EQUIPMENT

All AMINO ACIDS — natural, synthetic, unnatural, Rare Sugars, Biochemical Products, Reagents, New Pharmaceuticals in stock. Write or phone PLaza 7-8171 for complete price list.
BIOS LABORATORIES, INC. 17 West 60th Street, New York 23, N. Y.

RATS Long-Evans (PAF) Wistar (PAF)
Bred for Research Work by Research Workers
PACIFIC ANIMAL FARMS
2457 Fletcher Dr., Los Angeles 39, Calif.

• HYPOPHYSECTOMIZED RATS
Shipped to all points via Air Express
For further information write
HORMONE ASSAY LABORATORIES, Inc. • 8159 South Spaulding Ave. Chicago 29, Ill.

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

SUPPLIES AND EQUIPMENT

SUPPLIES AND EQUIPMENT

HOLTZMAN RAT COMPANY

. . . Continuity of Quality & Dependability of Supply

Route 4, Badger Lane · Madison 5, Wisc. · Phone 6-5573

H·M·CHEMICAL·Co. 1651 - 18th Street Santa Monica, California

QUALITY - AMINO ACIDS

and other products you need are listed in our catalogue. Send for our

NEW-SUPPLEMENT

September, 1954

TACONIC FARMS

Germantown, N. Y.

Germantown 3535

- **Swiss Mice**
- **Webster Strain**

MACHLETT

Your assurance of the finest laboratory supplies, scientific instruments, chemicals and glassblowing.

E. Machlett & Son • 220 E. 23rd St. • N. Y. 10, N. Y.

L-GLUTAMINE

AND ITS ANTI-METABOLITE

DL α METHYLGLUTAMIC ACID

TWO OF OUR 300 AMINO ACIDS (L, D, DL)

1500 MANN ASSAYED BIOCHEMICALS

Price List #120 on Request

MANN RESEARCH LABORATORIES

132 Liberty St., New York 6, N. Y.

• *Hamsters* • *Guinea Pigs* • *Rabbits* •

• *Rats* • *Mice* • *Cats* • *Dogs*

RESEARCH

MANOR FARMS

Staatsburg, New York

Tel. Staatsburg 3278

Supplying every Research Need Since 1943

SPRAGUE–DAWLEY, INC.

Pioneers in the development of the

STANDARD LABORATORY RAT

Our new modern colony building just completed soon will double our present production.

The new colony building contains every device to insure continuous production and shipment of guaranteed Sprague-Dawley strain white rats.

Limited shipments of males from the new colony will be available about March 15, 1954.

Increased orders from our present customers and orders from new customers will be accepted as production builds up.

OUR PLEDGE: Our insistence on the highest possible quality will never be sacrificed to quantity.

SPRAGUE–DAWLEY, INC. P.O. BOX 2071 Madison, Wisconsin

Ask For GBI Price List

GBI research products, in convenient small packages—are offered as a special service to investigators. They will save you time, trouble and expense if you are engaged in research in these fields. →

BIOLOGICAL

MICROBIOLOGICAL

BACTERIOLOGICAL

BIOCHEMICAL

NUTRITIONAL

←*Write for this useful reference book listing hundreds of items for research.*

...GBI.. General Biochemicals, Inc.

72 LABORATORY PARK, CHAGRIN FALLS, OHIO

A

NEW COMFORT and PROTECTION in these

LABORATORY APRONS

These new black rubber aprons are ingeniously designed to give complete protection while avoiding perspiration. A band of webbing, not directly attached to the underside of the apron, fits around the waist and ties in back. Smaller pieces of webbing at each side of the apron have eyelets through which the waistband passes. By moving these pieces backward the apron fits closely to the body as in Illustration A. By moving them forward the apron is held loosely in position away from the body, as in Illustration B, permitting ventilation, but providing protection at the same time.

B

Cat. No. 11885

Aprons, black rubber 26" x 36" ..... each $1.75
" " " 26" x 45" ..... each $2.50

10% off in Lots of 1 Dozen

Also available on light-weight and heavy-weight double-coated maroon. Write for prices.

Announcing . . .

A NEW BUNSEN-TYPE BURNER

- **No Gas Installation Required**
- **Portable-Lightweight-Handy**
- **Greater Heat Potential**

TURNER *BUNSEN-TYPE* BURNER

- Uses LP (Liquefied Petroleum) gas in handy, disposable tank. No re-filling problem . . . tank can be replaced in less than a minute.
- Portable, lightweight, handy . . . eliminates need for gas piping . . . ideal for general laboratory, industrial and schoolroom use.
- All brass burner, control valve, and fittings.
- Unit is 5⅞" high in operating position . . . designed for use with Turner ⅝" Bunsen burner fittings, standard laboratory tripods, hot plates, etc.
- Wire cradle holds tank securely . . . permits burner to be operated at any angle.
- Lights instantly . . . has just one valve for finger-tip, positive flame adjustment . . . safe operation.
- Heavy-gauge tank is I.C.C. approved; complete with pressure relief valve.

Cat. No. 33580—Per Unit (Cradle Included) .. $7.95
Cat. No. 33581—Replacement Tank ..... ea. $1.95

Now You Can Make Your Pipette Rinser A PIPETTE WASHER!

with TER-G-TABS

The New, SLOW-DISSOLVING, Effervescent Tablet for Pipette Washers

Just place a tablet in the bottom of a Pipette Washer. When warm water (140° to 160° F) is allowed to run through the washer it will automatically AND SLOWLY dissolve the tablet, permitting the freshly-dissolved detergent to rise through the pipettes with each cycle of filling and emptying of the washer (usually 6 to 8 times a minute).

TER-G-TABS require 6 to 10 minutes to dissolve, after which, the clear water running through the washer provides the rinsing action.

TER-G-TABS—100 Tablets $5.00

SEND FOR FREE SAMPLE

STANDARD SCIENTIFIC SUPPLY CORP.
34 West 4th Street • New York 12, N. Y.

ALL THE APPARATUS, EQUIPMENT, SUPPLIES, CHEMICALS AND REAGENTS NEEDED TO RUN TODAY'S MODERN LABORATORIES.

BAUSCH & LOMB

"SPECTRONIC 20"

SPECTROPHOTOMETER

COLORIMETER

9084-K.

DIFFRACTION GRATING TYPE

- Range 375 mmμ in the violet to 950 mmu in infrared.
- Band width 20 mmu.
- Direct reading in transmission or optical density.
- Plug-in printed electronic circuit.

"SPECTRONIC 20", Bausch & Lomb. A wide range, compact, versatile, direct reading instrument, with high degree of accuracy, simple to operate, and at remarkably low price. Effective band width 20 mmu. Provides monochromatic light in range from 375 mmu in the violet to 950 mmu in infrared. Wavelength dial graduated at intervals of 5 mmu.

Consisting of diffraction grating monochromator with prefocused light source and fixed slits; phototubes; electronic amplification system and built-in transformer for a.c. operation; and meter for direct indication of transmission and optical density. Three controls adjust the wavelength setting, light intensity and zero, respectively. Results are reproducible within 0.5%.

9084-K. Spectrophotometer-Colorimeter, B.&L. "Spectronic 20", as above described, with blue and red-sensitive phototubes and filter, for routine colorimetric determinations at a single wavelength; with single place sample holder and three ½-inch test tubes. For 115 volts, 60 cyc., a.c. 230.00

9085-M. Special External Voltage Stabilizing Transformer, recommended for use with above to insure stable operation 30.00

9084-E. Spectrophotometer-Colorimeter, B.&L. "Spectronic 20", complete outfit for rapid spectral scanning and plotting of absorption curves; consisting of 9084-K with blue and red-sensitive phototubes and filter, 9085-M Voltage Stabilizing Transformer and 9085-C Thomas Roto-Cell with double 1 ml cell for 10 mm light paths. For 115 volts, 60 cyc., a.c. 336.20

THOMAS ROTO-CELL

9085-C.

A liquid-cooled double cell carrier, for rapid spectrophotometric scanning at controlled temperatures. Readily interchangeable with the single place sample holder of Spectronic 20 and permits instantaneous interchange within the instrument of a 1 ml sample and blank or standard into the light path, thereby greatly facilitating preparation of spectral transmission or absorption curves.

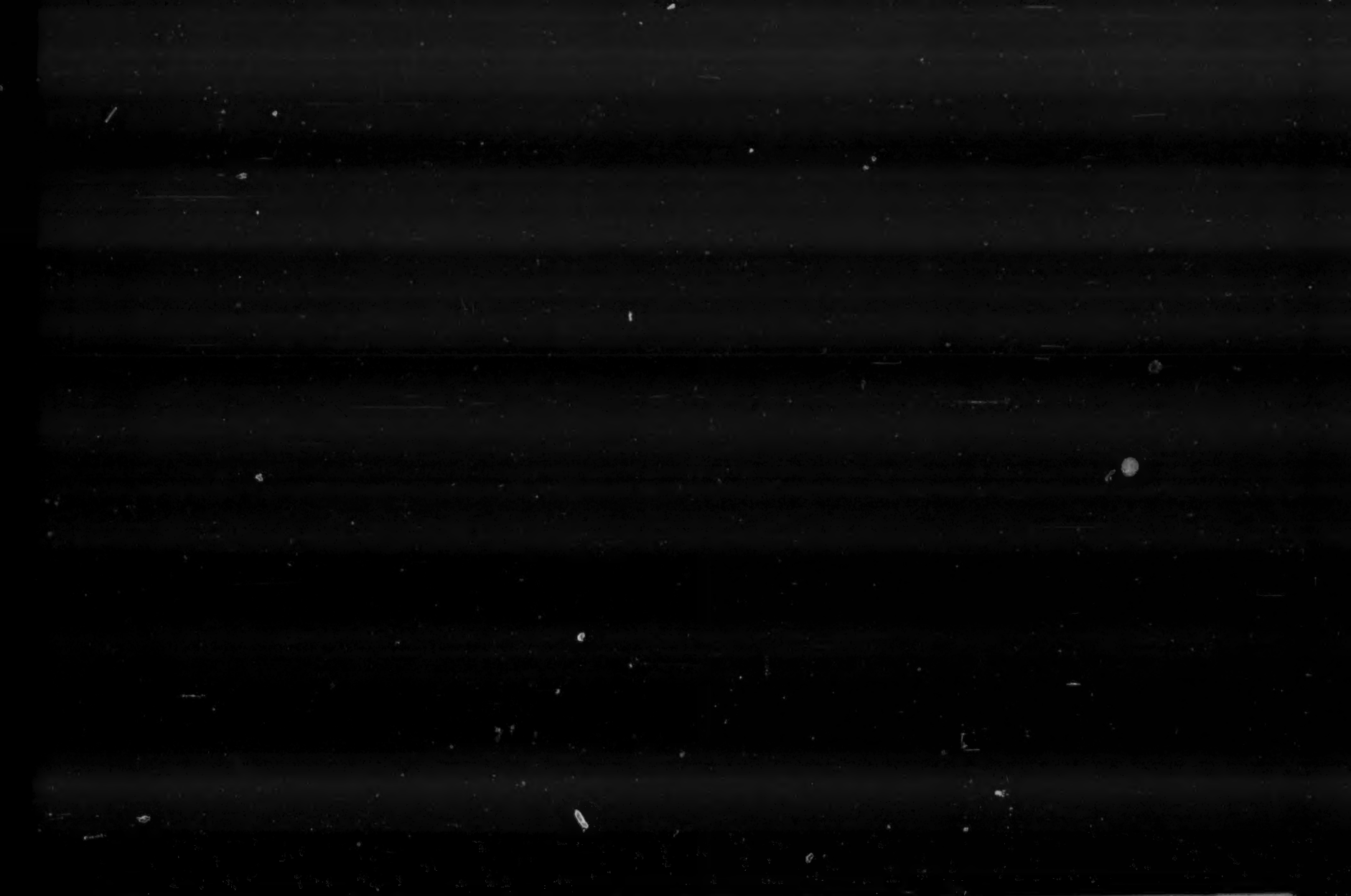
9085-C. Roto-Cell, Thomas, complete with double cell of Corex glass with 10 mm light paths and covers 76.20

Copy of Bulletin 121 sent upon request.

SYMBOL OF QUALITY
A.H.T.CO.
SPECIFICATION
LABORATORY APPARATUS

ARTHUR H. THOMAS COMPANY

Laboratory Apparatus and Reagents

WEST WASHINGTON SQUARE PHILADELPHIA 5, PA.

Teletype Services: Western Union WUX and Bell System PH-72